ENGINEERING NEWS-RECORD

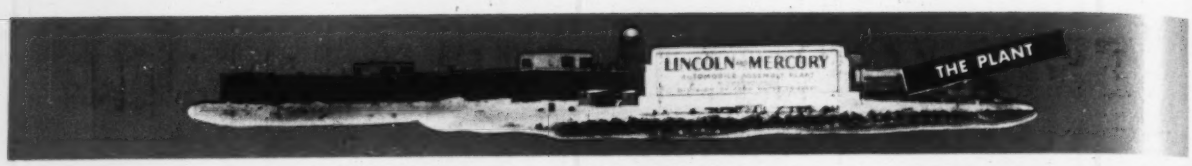
A McGRAW-HILL PUBLICATION

AUGUST 5, 1948

Bonneville Power Dam on the Columbia River at Portland, Oregon, is the first dam to be built across the Columbia River on Pacific Coast

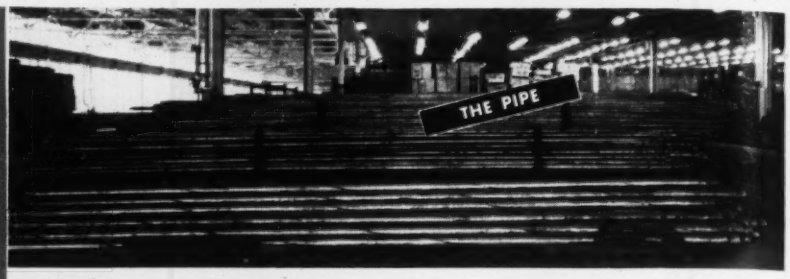
WITH ARTICLES ON: MOVING MOUNTAINS TO MAKE A HIGHWAY

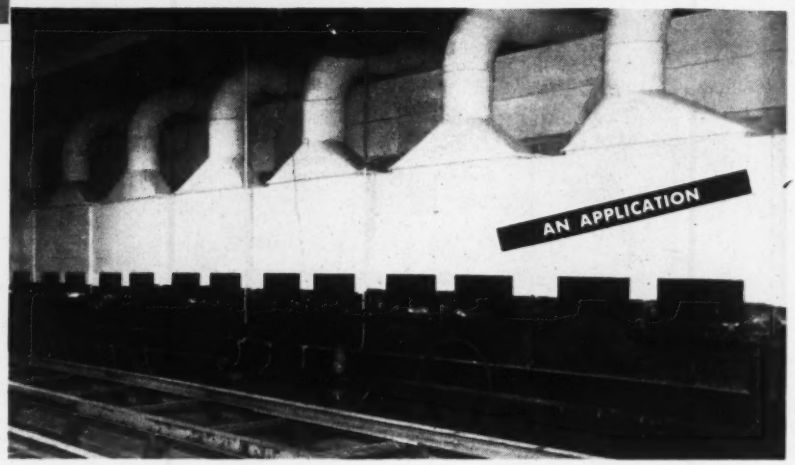
HUGE PRECAST PIPES HALT OUTFALL LEAKAGE



Ford Motor Company uses *BYERS WROUGHT IRON PIPE*

to cut maintenance costs





The new Lincoln-Mercury assembly plant at Metuchen, N.J., naturally reflects the latest ideas and developments in every detail of design and construction . . . including major emphasis on the elimination of excessive maintenance. Ford Motor Company engineers specified wrought iron to forestall corrosive attack in certain services. One—illustrated—is recirculating water lines for washing air in the paint spray booths. Another—for which part of the pipe stock is shown—is a water cooling system for transformers to press machinery. The fabricator on this job was Consolidated Installations, Inc.

WATER HAZARD

With all the variety of fluids that piping is called on to handle today, water is still Public Enemy No. One in causing excessive repairs, and excessive replacements. Supplies vary widely in analyses. Only individual study and expert interpretation can predict the probable effect on piping. And only long familiarity with the performance of pipe materials under these varied conditions can provide a safe, sound basis for foretelling performance. A. M. Byers Company has the facilities and the accumulated experience to give right answers to these perplexing questions. And wrought iron has the inherent corrosion-resistance needed to successfully combat attack, in a large majority of situations.

INHERENT RESISTANCE

The corrosion-resistance of Byers Wrought Iron pipe comes directly from the unique structure and composition of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack. The threads also help anchor the initial protective scale, which shields the underlying metal.

ASK FOR DETAILS

A knowledge of the character, manufacture, and properties of wrought iron is an excellent first-step in applying it correctly. Our booklet, "The ABC's of Wrought Iron" covers this entire subject. We will be glad to send you a copy. If you have any specific questions in connection with projected jobs, ask a representative, or the nearest District Office, for information.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

ENGINEERING NEWS-RECORD

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VOLUME 141 AUGUST 5, 1948 NUMBER 6

FEATURES IN THIS ISSUE

Outfall Has Precast Units 100 ft. Long ... 64

Ford Builds an Auto Plant in Georgia ... 68

Rock Fill Diverts River at Davis Dam ... 71

Notes on Legal Decisions ... 72

Moving Mountains to Make a Highway ... 73

Report on Vibration Generators Available ... 75

Steel-Drum Crib for Cleveland Intake ... A. A. BURGER 76

Bridge Piles Driven by Precision Methods ... 80

China's Transportation Need ... 83

Diversion Factors for Combined Sewers—R. J. THEROUX, R. L. MEEK 86

Blame Weed Killer for Roadside Fire ... 87

Welded Studs Cut Costs and Speed Work on Roofing Job ... 88

California Must Conserve Water ... 90

State Requirements for Airport Construction ... 92

DEPARTMENTS

Construction Trends ... 47

News of the Week ... 53

Editorials ... 62

Book Reviews ... 95

Material Prices ... 98

New Products ... 104

Manufacturers' Publications ... 104

Elections and Activities ... 132

Men and Jobs ... 134

Manufacturers' Activities ... 136

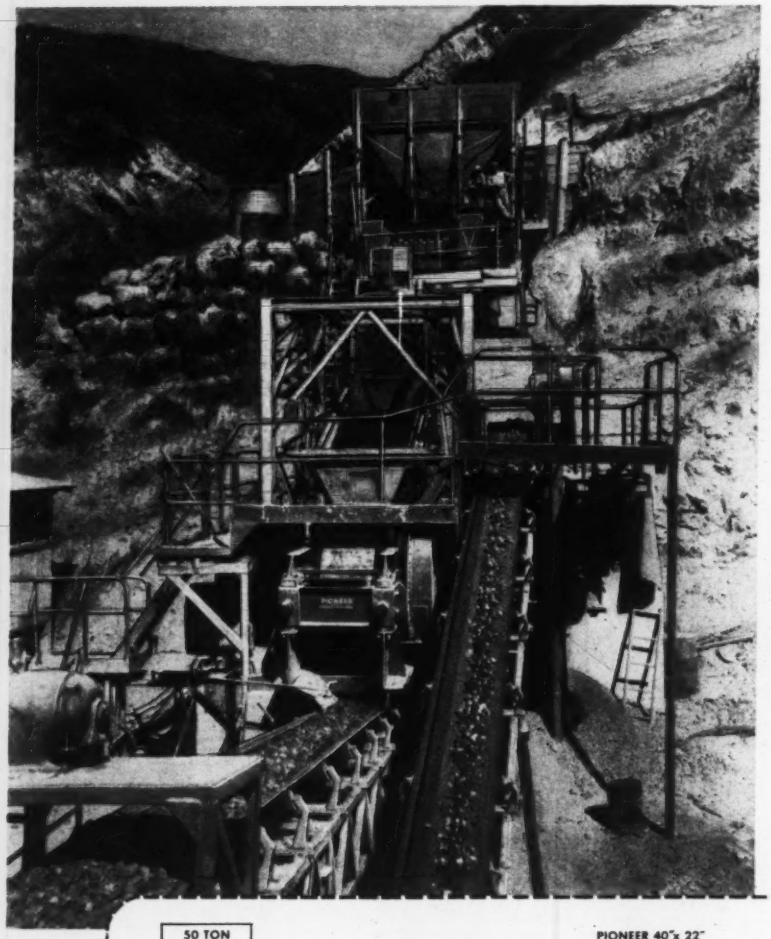
Engineering School News ... 142

Construction Reports ... 163

Number of copies of this issue printed 43,897

Can you match these figures?

Pioneer Jaw and Roll Crushers produce 300 tons of 1" minus granite an hour near San Pedro, California!



Here's one of the most dramatic production stories in the quarry industry . . . tremendous production . . . amazing maintenance . . . precision reduction. Again, a PIONEER Jaw Crusher, Roll Crushers, and Vibrating Screens have proved the answer to a tough production job.

Livingston Truck and Materials Co., produces crusher run base rock for street sub-grade, water front fill and for plant mix asphalt. The rock . . . granite of variable hardness. Their product . . . about 300 tons of 1" minus crusher run base an hour.

While production is high, maintenance has been equally low. Here's what Mr. Carder Livingston, General Manager, says:

"The performance of the **PIONEER** *54 x 24 Roll Crusher with respect to capacity and economy of operation has been remarkable. Before installation of the* **PIONEER** *30 x 42 Jaw Crusher, the Roll Crusher received rock from the old primary to about 8", set at about 2". It crushed approximately 1,000 tons per day over a 9 month period before resurfacing the roll shells. This same Roll Crusher now receives 5" to 6" material and is producing 1200 tons a day. The roll shells show virtually no wear after 6 months use."*

Production stories like these are no surprise to those quarry operators who own and operate PIONEER Roll Crushers. With 100% of the shell surface a working surface, roll crushers have a higher capacity for fine materials than any other secondary crusher. PIONEER Roll Crushers are made in four sizes . . . to fit any job in pit, mine, or quarry. Why not write us for full details today? Delivery is prompt!

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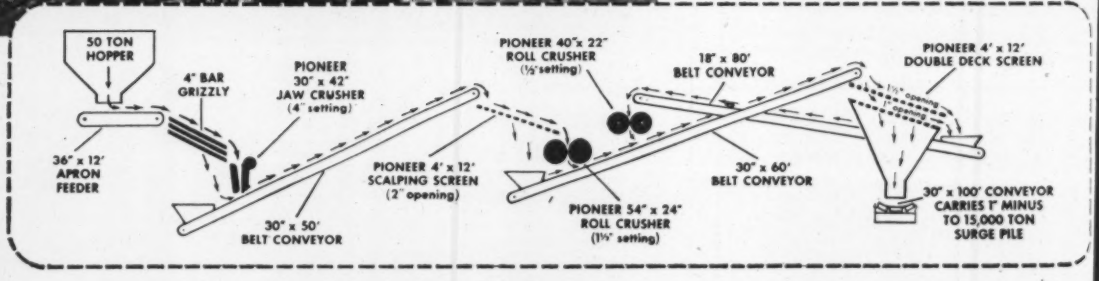

50 TON HOPPER
4" BAR GRIZZLY
PIONEER 30" x 42" JAW CRUSHER (4" setting)
36" x 12' APRON FEEDER
30" x 50' BELT CONVEYOR
PIONEER 4' x 12' SCALPING SCREEN (2" opening)
PIONEER 40"x 22" ROLL CRUSHER (½" setting)
PIONEER 54" x 24" ROLL CRUSHER (1½" setting)
18" x 80' BELT CONVEYOR
30" x 60' BELT CONVEYOR
PIONEER 4' x 12' DOUBLE DECK SCREEN
30" x 100' CONVEYOR CARRIES 1" MINUS TO 15,000 TON SURGE PILE

BUY BOTH!

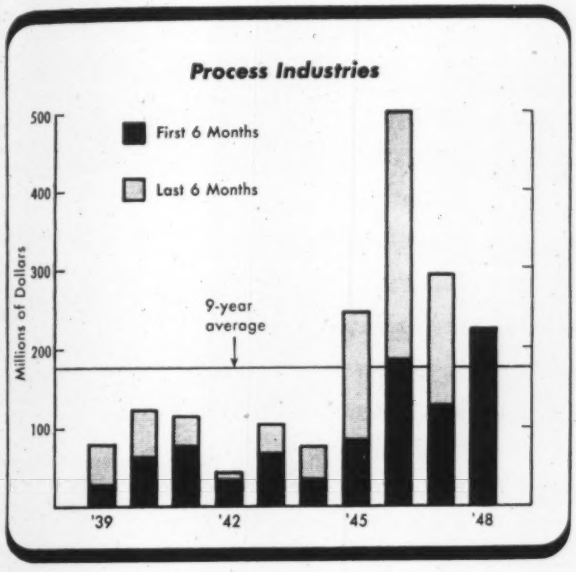
Higher Output, Lower Upkeep!

Pioneer

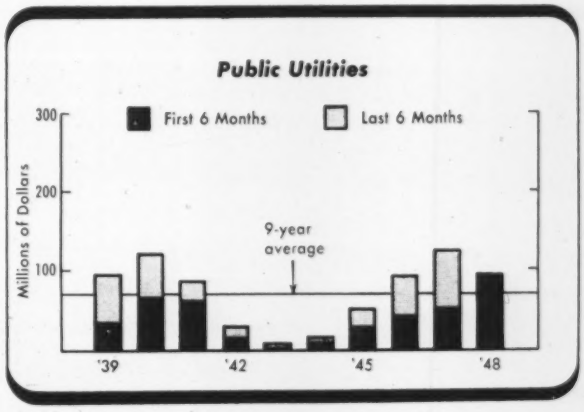
Continuflo **EQUIPMENT**

CONSTRUCTION TRENDS

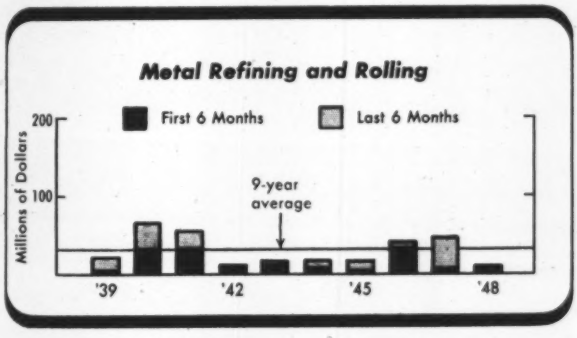
Industrial Building Contracts Are 34% Above 1947 with...



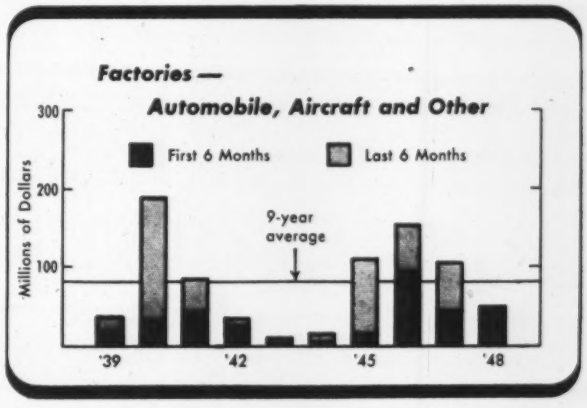
... Process Industries up 75 percent



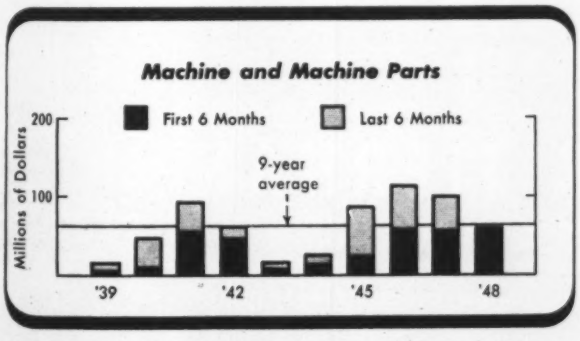
... Public Utilities up 89 percent



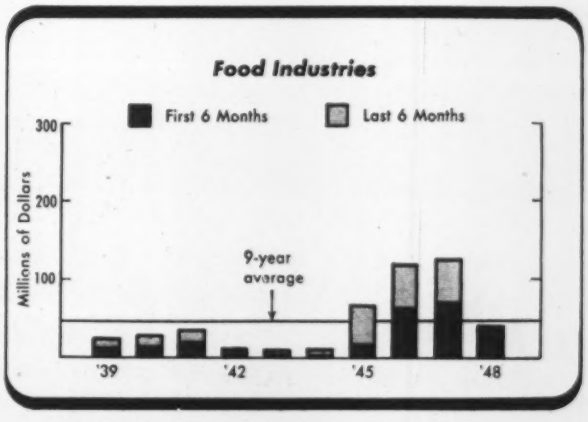
... Metal and Metal Refining Plants up 92 percent



... General Factories up 16 percent



... Machine and Machine Parts Plants up 3 percent



... Food Industries down 44 percent

You can't see the most important item

QUALITY isn't listed on the assembly drawing; but it *is* built into every W&T Chlorinator. It's there because neither you nor we want to take chances with the protection of public health—one of chlorination's important roles in water supply, sewage treatment and swimming pools. In their many industrial uses, too, from controlling slime in paper mills to preventing spoilage in food processing, you'll find this same craftsmanship and careful manufacturing—the kind that keep W&T chlorinators on the job economically year after year.

So when chlorination is indicated look to dependable W&T equipment, backed by over thirty years' experience, if you want the kind of installation your client will still thank you for 10 or 20 years from now.

S-29

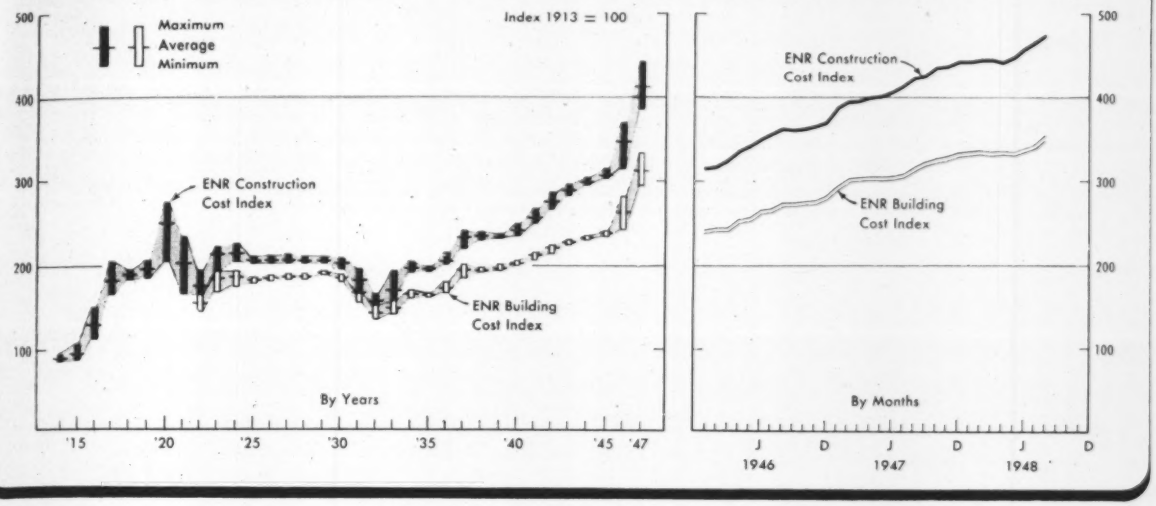
WALLACE & TIERNAN COMPANY, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

AUGUST CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS-RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	July 1947 (5 wk.)	July 1948 (5 wk.)	% Change	Seven Months 1947 (31 wk.)	Seven Months 1948 (31 wk.)	% Change
Total U. S. Construction	524,238	713,719	+36	3,198,103	4,047,088	+27
Private Construction	253,321	357,495	+41	1,795,756	1,981,865	+10
Public Construction	270,917	356,224	+31	1,402,347	2,065,223	+47
Federal	76,737	74,886	−2	408,675	602,049	+47
E N R Construction Volume Index, 1913 = 100	218	213	−2	271	244	−10
Total New Productive Capital	1,382,401	2,503,673	+81	2,271,646	4,683,791	+106
Private Investment	315,961	517,452	+64	1,205,206	2,697,570	+124
Federal (non-federal work)	247,711	427,289	+72	247,711	427,289	+72
Federal (federal work)	818,729	1,558,932	+90	818,729	1,558,932	+90

CONSTRUCTION COSTS . . . WAGE RATES . . . MATERIAL PRICES

1913 = 100	August 1947	August 1948	% Change	Change July to August 1947 July	1947 August	1947 %	Change July to August 1948 July	1948 August	1948 %
E N R Constr. Cost Index†	422.85	475.51	+12.45	413.75	422.85	2.20	463.23	475.51	+2.65
E N R Building Cost Index†	317.75	355.45	+11.86	308.90	317.75	2.87	342.42	355.45	+3.81

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.237	$1.386	+12.05	$1.233	$1.237	+.32	$1.386	$1.386	0.0
Skilled Labor (Av.3 Trades)	2.081	2.298	+10.43	2.073	2.081	+.39	2.287	2.298	+.48
Bricklayers	2.227	2.504	+12.44	2.215	2.227	+.54	2.456	2.504	+1.95
Structural Ironworkers	2.079	2.290	+10.15	2.067	2.079	+.58	2.290	2.290	0.0
Carpenters	1.938	2.124	+9.60	1.938	1.938	0.0	2.114	2.124	+.47
Cement, bulk, per barrel	2.54	2.92	+14.96	2.53	2.54	+.40	2.82	2.92	+3.55
Structural Steel, base	2.80	3.25	+16.07	2.50	2.80	+12.00	2.75	3.25	+18.18
Sand, per ton	1.797	2.015	+12.13	1.782	1.797	+.84	1.960	2.015	+2.81
Lumber, 2x4 Fir, per M ft.	88.05	99.44	+12.94	86.29	88.05	+2.04	97.28	99.44	+2.22
Lumber, 2x4 Pine, per M ft.	77.91	86.47	+10.99	77.31	77.91	+.78	88.41	86.47	−2.19
Common brick, per M	23.200	26.238	+13.09	22.850	23.200	+1.53	25.850	26.238	+1.50
Ready-mixed concrete, c.y.	9.018	10.079	+11.77	8.934	9.018	+.94	9.995	10.079	+.84
Struct. clay tile, 3x12x12	118.41	124.19	+4.88	118.41	118.41	0.0	124.03	124.19	+.13

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	July 1947	July 1948	% Change	June 1948	% Change June to July
Steel (% operating Capacity) A.I.S.I., weekly average	86.0	92.4	+7.4	96.1	−3.9

	May 1947	May 1948	% Change	Five Months 1947	Five Months 1948	% Change
Cement, thous. bbl. U.S.B. of Mines	15,328	19,544	+27.5	59,704	70,091	+17.4

	June 1947	June 1948	% Change	Six Months 1947	Six Months 1948	% Change
Fabricated Structural Steel, tons, A.I.S.C.	151,882	147,697	−2.8	878,829	948,030	+7.9
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$280,579	$381,863	+36.1	$1,282,782	$1,960,247	+52.8

COST OF LIVING INDEX . . . . EMPLOYMENT

Base 1935–39 = 100	June 1941	June 1947	June 1948	% Change	May 1948	% Change May to June
Consumers' Price Index, B L S	105.2	157.1	171.7	+9.3	170.5	+0.7
Rent (Housing) Index, B L S	106.2	109.2	117.0	+7.1	116.7	+0.3

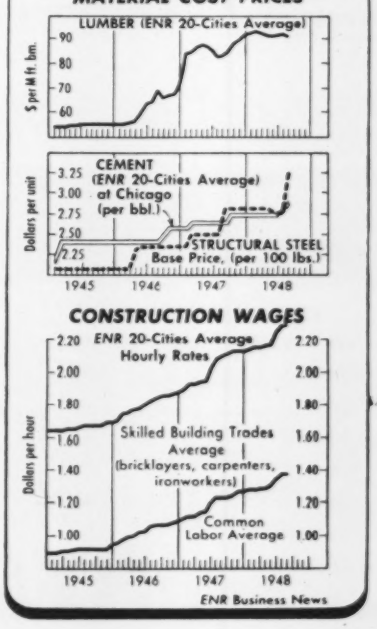
	June 1947	June 1948	% Change	May 1948	% Change May to June
Contract Constr. Employ. (est.), thous., B L S	1,957*	2,182*	+11.5	2,049*	+6.5

*Revised.

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Aug., 1948	475.51	228.58	355.45	192.15	...	...
July, 1948	463.23	222.67	342.42	185.10	213	93
June, 1948	455.80	219.10	339.26	183.39	282	124
May, 1948	447.86	215.29	333.93	180.51	258	113
Apr., 1948	443.64	213.26	334.56	180.85	302	132
Mar., 1948	443.60	213.24	334.22	180.67	247	108
Feb., 1948	442.67	212.79	335.49	181.36	231	101
Jan., 1948	441.65	212.30	333.58	180.32	173	76
Dec., 1947	441.13	212.05	333.06	180.04	246	108
Nov., 1947	436.91	210.02	329.22	177.97	234	103
Oct., 1947	434.58	208.90	327.29	176.92	228	100
Sept., 1947	426.38	204.96	322.58	174.38	250	110
Aug., 1947	422.85	203.26	317.75	171.77	211	93
July, 1947	413.75	198.89	308.90	166.98	218	96
1947 (Av.	413.16	198.61	312.96	169.18	228	100
1946 (Av.)	346.04	166.34	262.35	141.82	248	109
1945 (Av.)	307.75	147.93	239.14	129.27	123	54
1944 (Av.)	298.72	143.59	234.73	126.89	96	42

MATERIAL COST PRICES



Steel Hard to Get?

Demand Still Exceeds Supply But . . .

. . . this is a typical view of night loading operations at a Ryerson steel-service plant. The steels specified on several orders are on their way to a loading platform for delivery the following morning. Possibly none of these orders are completely filled—however, the fact remains, we are doing our very best to serve a large group of steel users.

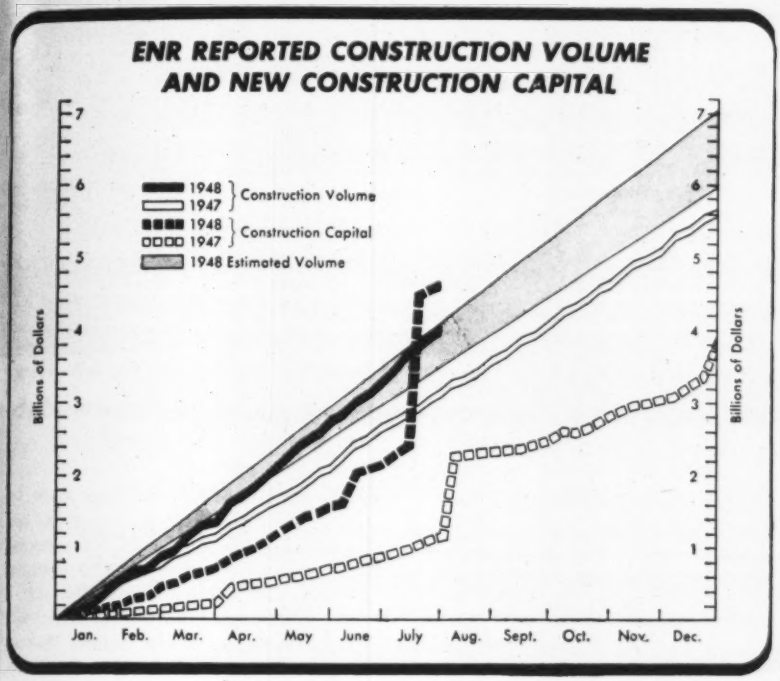
Unfortunately, it often seems that the particular steel *you* want is never on hand, and it is true that we are always short of some kinds and sizes. But our stocks turn over fast. A size that is out today may be in tomorrow. And in spite of current conditions, we still believe the over-all stocks at our thirteen plants are the nation's largest.

Carbon and alloy steels, hot rolled or cold finished, and stainless steel in practically every analysis and finish are in stock, ready for your call. So do not hesitate to get in touch with us —on any requirement. You'll find that every Ryerson steel man will do everything possible to help you get the steel you need, when you need it.

Joseph T. Ryerson & Son, Inc. Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

RYERSON STEEL

New Construction Volume in July



Civil engineering construction volume in continental United States totals $713,719,000 for July. The weekly average of $142,744,000 for each of the five weeks of the month is the third highest average recorded in the postwar period, exceeded only in April and June this year when the weekly volume averaged $155,432,000 and $149,083,000, respectively. This month's weekly average is 4 percent below the weekly average for June, 1948 but 36 percent above the average for July, 1947, according to *Engineering News-Record.*

Private construction for July is 14 percent below last month and 41 percent above July, 1947. Public construction is 7 percent above last month and 31 percent above last July. State and municipal construction is 9 percent above last month and 45 percent above the July, 1947 figure. Federal construction, 3 percent above last month, is down 2 percent from July, 1947.

The various classes of construction for July, 1948 compared with June, 1948 show gains in private unclassified of 98 percent; public unclassified, 60 percent; waterways, 57 percent; sewerage, 27 percent; public buildings, 23 percent. Losses are recorded for highways of 2 percent; commercial buildings, 8 percent; earthwork and drainage, 18 percent; public bridges, 32 percent; industrial buildings, 60 percent; and private bridges, 81 percent.

Geographically, gains in July, 1948 over June, 1948 are shown in New England of 14 percent, and West of the Mississippi of 8 percent. Losses were shown in the South of 3 percent; Mid-West, 4 percent; Mid-Atlantic, 6 percent; and Far West, 29 percent.

Five sections made gains in July over July, 1947—West of the Mississippi, 101 percent; New England, 75 percent; Mid-West, 36 percent; Mid-Atlantic, 24 percent; and Far West, 22 percent. A loss of 11 percent was shown in the Southern section.

New capital for construction for the five weeks of July, 1948 totals $2,503,673,000, including federal appropriations for the fiscal year of 1949 of $1,558,932,000, 90 percent greater than the $818,729,000 in 1947, and federal aid for highways of $427,289,000, 72 percent greater than in 1947. New construction capital in July, 1947, including federal appropriations, was $2,271,646,000.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD JULY, 1948

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation,* $28,000, *other public works* $50,000, *industrial buildings,* $68,000, *other buildings,* $250,000

Thousands of Dollars (000 Omitted)

Public Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States July 1948	United States Seven Months 1948	United States Seven Months 1947	% Change '47 to '48	Canada
Waterworks	236	842	3,421	522	6,293	968	12,282	110,745	65,665	+69	2,403
Sewerage	126	2,498	4,531	2,986	8,862	5,812	24,815	127,572	76,413	+67	1,671
Bridges, public	1,104	7,611	4,227	2,471	7,725	3,368	26,506	170,182	100,862	+69	273
Earthwork and waterways	10	162	7,735	479	14,203	5,307	27,896	300,346	190,709	+57	796
Street and roads	2,280	24,887	18,781	16,402	37,207	16,115	115,672	595,256	474,428	+25	3,552
Buildings, public	16,354	27,313	18,400	14,720	25,726	19,314	121,827	631,243	325,704	+94	15,456
Unclassified, public	1,521	3,668	8,102	814	8,234	4,887	27,226	129,879	168,566	-23	4,185
Total public	21,631	66,981	65,197	38,394	108,250	55,771	356,224	2,065,223	1,402,347	+47	28,336
Federal government (included in above classifications)	5,536	5,381	16,035	2,647	29,405	15,882	74,886	602,049	408,675	+47	
Private											
Bridges, private			50		273		323	2,485	684	+263	
Industrial buildings	3,859	6,942	5,277	12,301	21,171	9,917	59,467	580,631	480,735	+21	19,236
Commercial buildings	3,650	97,698	17,651	10,270	43,865	16,028	189,162	1,153,823	1,049,975	+10	13,076
Unclassified, private	500	425	13,427	37,310	55,499	1,382	108,543	244,926	264,362	-7	
Total private	8,009	105,065	36,405	59,881	120,808	27,327	357,495	1,981,865	1,795,756	+10	32,312
Total Engineering Construction											
July 1948 5 weeks	29,640	172,046	101,602	98,275	229,058	83,098	713,719				60,648
June 1948 4 weeks	20,749	146,684	83,625	81,553	169,754	93,967	596,332				39,784
July 1947 5 weeks	16,888	138,606	113,837	72,491	114,239	68,177	524,238				61,468
Seven months 1948	177,824	1,122,242	653,706	476,377	1,053,648	563,291		4,047,088			251,815
Seven months 1947	121,357	805,238	581,146	425,005	730,982	534,375			3,198,103		280,084
% Change '47 to '48	+47	+39	+12	+12	+44	+5				+27	-10

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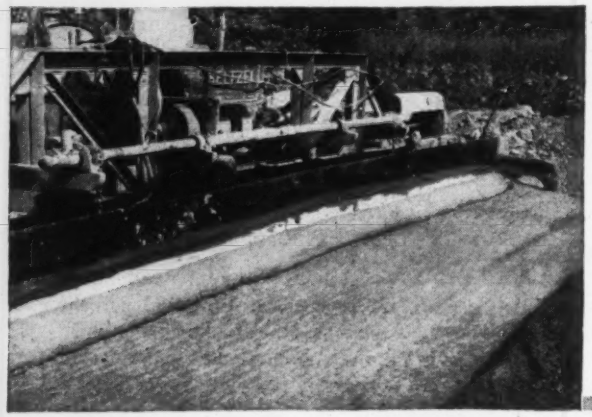
CONCRETE SPREADS EASIER

Concrete made with Duraplastic air-entraining cement requires less mixing water for a given slump. The mix is more uniform and more plastic. It dumps, spreads, and finishes easily. Segregation and bleeding are minimized. Reduced bleeding allows finishers to work closely behind the mixer.



SCREEDS AND ROLLS MORE EASILY

Billions of tiny air bubbles, created by Duraplastic air-entraining cement in the concrete, act like ball bearings that hold apart the particles of fine and coarse aggregates. And while the solid particles can roll easily on the bubbles, they cannot roll freely through or around the bubbles. This prevents the particles from settling or moving out of their relative positions.

MAKES MORE DURABLE CONCRETE

Numerous installations show conclusively that Duraplastic air-entrained concrete is more resistant than regular cement concrete to the effects of freezing-thawing weather and to the scaling action of de-icing salts. Yet Duraplastic costs no more than regular cement.

Duraplastic complies with ASTM and Federal Specifications and has interground with the cement the precise amount of air-entraining material needed for satisfactory field performance. For further information write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

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"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—September to June—ABC Network*

News of the Week

ENGINEERING NEWS-RECORD • AUGUST 5, 1948 • VOLUME 141 • NUMBER 6

See thin prospect of action on construction legislation

Capital observers agree special Congress session probably will do little on matters of engineering interest—stress defense possibilities of proposed steam plants

As Congress began its second week of work under President Truman's call for a special session, Washington observers saw little prospect of action on matters of engineering interest.

The President's initial message to the special session brought up for renewed debate such matters as the Taft-Ellender-Wagner housing bill, the Tennessee Valley Authority's ill-fated proposal for a standby steam power plant and general public-power policies, but as the first week closed amid political charges and counter-charges, it was apparent that very little definite action would result.

Housing has best chance

Of all of the matters of interest to the construction industry, the housing bill appeared to have the best chance of at least coming up for new consideration.

Since Congress adjourned early Sunday morning, June 20, both major parties have endorsed federal aid to needed public low-rent housing in their campaign platforms. In the case of the Republicans, the platform endorsement was seen in some quarters as a partial repudiation of the action of Republican House leaders in blocking a vote on the TEW bill (*ENR* April 29,vol.p.621).

The measure—Senate Bill 866—had a stormy career in the House, following its passage by the Senate on April 23. Hearings by the House Banking and Currency Committee ran into June, then exploded when Chairman Wolcott of the committee offered a substitute bill that omitted the controversial elements of public housing: Slum clearance, rural housing and federally-centralized housing research. The committee retaliated by tacking all of these matters onto the Wolcott measure as amendments, and then reported out the amended bill.

But the House Rules Committee then blocked the bill by tabling it. Mr. Wolcott then introduced another substitute measure meeting his specifications, and the House rammed it through under suspension of rules. In the Senate, this new measure was blocked.

However, under urging of the Republican platform-writers, the House in the small hours of June 20 hastily passed a Wolcott-amended Senate bill (S. 2790), and the Senate followed suit. Now in effect as Public Law 864, this last-minute measure meets few of the requirements set forth by private home builders, and none of the requirements urged by the public housing agencies (*ENR* July 1, p. 1).

Since the special session is a continuation of the 80th Congress, bills already part way through the two houses retain their position. Thus the Senate's TEW bill is still in the House Banking and Currency Committee, and the two House bills are still in the Senate Banking Committee.

Power outlook dark

Chances for further consideration of public power proposals hinge on the attitude of Congress—and Senator Bridges and Representative Taber, chairmen of the appropriations committees of the two houses, had already declared against any reconsideration of money requests which previously had been acted upon.

The TVA's proposed new steam generating plant at New Johnsonville, Tenn., is one of the several power projects that were brought up in the President's opening address to the session.

The President's emphasis on the national defense aspect of steam plants brought a new factor into the debate.

The TVA's New Johnsonville plant by implication was reported to have been proposed to provide standby power for Oak Ridge.

Construction in '48 to cost $18 billion

New construction put in place in 1948 probably will reach $18,000,000,000, John L. Haynes, chief, construction division, Department of Commerce, said last week.

This figure, a joint estimate of the Department of Commerce and the Department of Labor, represents a 29-percent gain over the $13,977,000,000 put in place in 1947 and is exclusive of expenditures for maintenance and repair. It sets a new high record in dollar value of new construction activity, but the physical volume of new construction will remain below previous peaks.

The $18,000,000,000 figure is substantially higher than the Commerce Department estimate of $15,200,000,000 made last fall. Most important single element in the increase is the anticipated rise in value of residential building from $6,000,000,000 to $7,100,000,000.

In Mr. Haynes' opinion, there is no evidence to justify changing an assumption made last November that 950,000 privately financed dwelling units would be started in 1948. Most of the increase in residential dollar volume comes from the fact that the average construction cost of houses built this year is turning out to be substantially higher than expected.

Private nonresidential building may total $3,750,000,000, an increase of 20 percent over last year. Within this total, industrial construction probably will decline by 16 percent from last year's figure. Commercial construction may rise by almost two-thirds.

The chief factor in a gain of 22 percent for public utility construction over the revised 1947 figures is the continuing expansion in telephone, electric light and power, and gas construction.

Highway construction and school and hospital building are important reasons for a rise of 35 percent in public construction to a figure amounting to 23 percent of total new construction.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Housing—J. J. Moore Co. engineers, and Maxwell Reid, architect, are planning a 15-story, 110-unit apartment building at *Oakland, Calif.*, to cost $2,000,000 . . . Work has started on Virginia Manor, a $1,236,700 brick veneer rental apartment building at *Dallas, Tex* . . . Work is under way on the 80-unit Forest Apartments at *Charlotte, N. C.* . . . A $1,242,000 apartment house of 210 units will be built on Laburnum Ave. in *Henrico County, Va.*, near Richmond. . . . *Toronto, Ont.*, has received a gift of $1,150,000 under the Slum Clearance Act for redevelopment of a 6-block slum area in the Regent Park district. Total cost of the project will be over $9,000,000.

Public Construction—A new state office building will be built at *Helena, Mont.*, to cost about $1,000,000 . . . Sketches have been approved for the $2,000,000 addition to the Memorial Union building at the University of Oklahoma at *Norman* . . . Applications for more than $4,000,000 in hospital and health center grants have been approved by the *Virginia* Hospital Advisory Council. . . . Expenditure of upwards of $10,000,000 in state and federal funds for permanent protective work to safeguard the Peninsula State Park and harbor at Erie, Pa., is being considered by U. S. Engineers and the Pennsylvania Department of Forests and Waters . . . *Kentucky* will give $1,000,000 to help provide more local hospitals . . . Preliminary approval has been given to plans for a $500,000 Wyoming University war memorial field house and stadium at *Laramie* .

Sewerage and Water Supply — A $3,000,000 water plant expansion is now in progress at *Edmonton, Alta.* . . . In *New York State* this month representatives of industry and the municipalities will be called into conference with legislators to plan details of a statewide water pollution control program.

Highways—Extension of the Pennsylvania Turnpike eastward 100 miles from the vicinity of *Harrisburg* will cost $87,000,000. . . . Tentative award of contracts totaling $1,883,000 was announced by the *Minnesoto* Highway Department. . . . Bids on over $2,000,000 worth of work have been asked for Aug. 10 by the *Virginia* Highway Department. . . . *Indiana* has let contracts for $3,326,352 in maintenance work, rejecting several other bids as exceeding estimates. . . . Reconstruction has begun on the joint C. N. R. and highway bridge over the Fraser River near *Mission, B. C.*, the structure having been washed out during the spring flood. . . . Plans for grade crossing eliminations costing $30,000,000 are being considered by the Louisville & Nashville R. R. Co. and *Louisville, Ky.*, authorities. . . . Maintenance on *Virginia* highways cost over $13,000,000 during the first six months of the year.

Industrial construction—Addition to the Scoville Manufacturing Co. rolling mill at *Waterbury, Conn.*, will be completed this year by Turner Construction Co. of New York. . . . *Russell, Ky.*, coal yards of the Chesapeake and Ohio Railway will be expanded at a cost of $9,000,000. . . . Plans for a $4,000,000 refrigerated storage and shipping warehouse have been approved by the *Erie, Pa.* Works, General Electric Co. . . . Permanent buildings of the Argonne National Laboratory of the Atomic Energy Commission in *DuPage County, Ill.*, will be built by the Austin Company of Chicago. . . . Utah Power and Light Co. has announced a $61,000,000 construction program for the next six years.

Corrections—In the April 29, 1948, issue the statement that out-of-state engineers need no license to practice in North Dakota was in error. Actually, registered engineers from out of the state must be registered in the state to practice for periods exceeding thirty days.

BANK HEADQUARTERS — This six-story, $1,850,000 building in downtown Minneapolis, Minn., will be headquarters for the Minnesota Federal Savings and Loan Association. Air-conditioned throughout, the structure will be of concrete and steel, faced with Indiana limestone. Madsen Construction Co., Minneapolis, is contractor, and W. G. Knoebel, St. Louis, Mo., is architect.

Army will build airport at Berlin end of air lift

Before flying back to Berlin, Gen. Lucius D. Clay, U. S. Military Governor in Germany, stated that his Army Engineers were going to start construction of another Berlin airport upon his return. The location has been selected; it is in the Spandau area of the city.

This airport will be in addition to the Tempelhof Airdrome, now being enlarged by construction of a second runway, and the Gatow Airport. The U. S. Air Force uses Tempelhof; the British land at Gatow.

Between them, the Americans and British have been averaging 2,500 tons a day, delivered to Berlin, General Clay said. The American wing of the airlift has been operating 50 C54's and a number of C47's.

General Clay declared that the airlift is completely capable of supplying Berlin as long as the American people want it to do so.

Army plans boat basins for Astoria, Ore., port

Plans have been completed by the Army Engineers for two major projects in the Astoria, Ore., area. One will provide adequate anchorage for laid-up ships of the merchant marine; the other will be a small boat basin along the city's waterfront. Cost of the two projects will approximate $5,000,000.

The reserve fleet basin will be constructed for the U. S. Maritime Commission and will occupy about 1 sq. mi. of tidewater area in Cathlamet Bay. The project, requiring removal of 12,000,000 cu. yd. of material from the basin, will provide space for 220 standard merchant ships.

The small boat basin will extend 800 ft. into the Columbia River, having facilities for 1,000 pleasure boats.

Bombproof arms plant for Smith and Wesson

In the belief that the Springfield, Mass., arms industry would be a major target in another war, Smith and Wesson Co. has built a portion of its new plant underground, it was announced recently.

Designed by Carl H. Hellstrom, president of the firm, the plant provides for speedy evacuation and production below ground.

Above-ground side walls slide open like overhead garage doors to prevent damage by blowing out in case of an explosion.

British Columbia faces $16 million flood bill

Cost of rebuilding nearly 200 miles of dikes lining the Fraser River is part of a $16,000,000 bill facing British Columbia as a result of this spring's disastrous floods.

F. G. Goodspeed, assistant chief engineer of the federal Public Works Department who represents the Dominion on a three-man diking board set up recently at Ottawa, reported that survey and drilling teams are now in the field gathering information on damage and availability of reconstruction materials.

Funds already voted for this reconstruction work total $6,000,000, with $4,500,000 coming from the federal government and the rest from the British Columbia provincial government.

In carrying out its studies, the diking board will get expert advice from Holland, England and the Mississippi Valley. Scale models of the Fraser River course will be used to speed design on the new dikes and breakwaters.

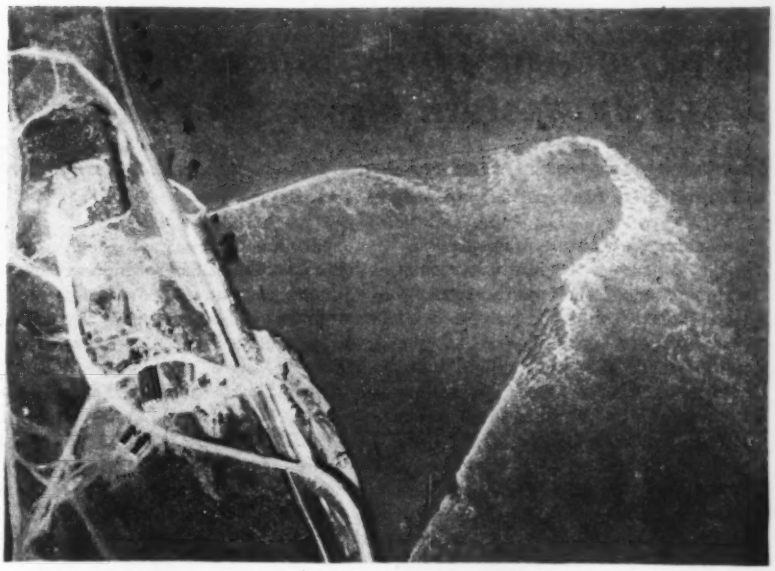
One model, covering the entire valley area above New Westminister, is now in use at National Research Council Laboratories in Ottawa, and plans are ready for a second model at the University of British Columbia, which will include the course below New Westminster to the mouth of the river.

Industries, USPHS make stream pollution studies

Fifteen research projects aimed at reducing sewage and industrial waste pollution of our water resources are under way at twelve universities and investigation centers, the U. S. Public Health Service announced last week. These studies are part of an estimated 140 projects now in progress in the fields of sewage treatment, industrial waste disposal, and stream sanitation.

Some of the 140 projects are sponsored by industries and some by the federal government at the USPHS laboratory in Cincinnati. Congress recently authorized future appropriation of $800,000 a year for the next five fiscal years to improve the inadequate facilities at the Cincinnati laboratory.

Sanitary engineering projects now in progress aim to improve the methods of measuring water pollution and to discover new methods of treating sewage and industrial wastes. The investigators in charge of the respective projects are recognized authorities in their fields, generally assisted part time by undergraduate and graduate students at the universities.



RIPPLES OUTLINE COFFERDAM—McNary damsite cofferdam (ENR April 29, vol. p. 619), pictured above as it appeared during peak of the Columbia River flood this spring, is now in repair, and work progresses. Bids have been received on shore construction on the Washington side of the river.

McNary Dam low bid is $21.6 million

Three Portland, Ore., construction companies jointly submitted the lowest bid for construction of a major portion of the navigation locks, fishways, spillway dam and other structures on the north shore of the Columbia River for McNary Dam. (*ENR* July 15, p. 15).

The joint low bid, $21,648,763, came from Guy F. Atkinson Co., Ostrander Construction Co., and J. M. Jones Construction Co., all of Portland. The government estimate, based on use of hired labor and government plant, was $23,648,619.

The Washington shore cofferdam, damaged by recent floods, has been repaired temporarily. Permanent repairs will be made during the low water season. Although work was delayed during the peak of the flood, there was no permanent setback to the construction program, according to Col. O. E. Walsh, Portland district engineer.

Cofferdam and navigation lock contracts are held by Guy F. Atkinson Co. The navigation lock will be 86 ft. deep and 500 ft. long.

When finished, the McNary project will have cost about $180,000,000. The dam will be 7,400 ft. long and 160 ft. high; the initial power installation will supply 828,000 kw. Designed capacity of the project is 1,380,000 kw.

Seek unified regulation of Mich. water controls

A program to unify regulation of Michigan flood control and water resources under a central agency was proposed recently by Stanley Fontanna, deputy director of the state conservation department, at a meeting of organizations concerned with state water problems.

The plan provides that administration of water problems—now scattered among several agencies—be grouped under a single head.

Recommendation for legislation will be prepared by the Michigan Economic Development Commission for early submission to the Legislature.

Colorado River rights seen vital to California

Settlement of Colorado River rights is a basic problem of southern California, Julian Hinds, general manager and chief engineer of the Metropolitan Water District, told the Colorado River Association recently. "There is no other source from which we can get the water we need for new homes, new industries, and new population," he said.

Hinds pointed out that Colorado River water use in southern California cities has increased by more than 100 mgd. since 1941. The number of people using Colorado River water has increased by more than 1,000,000 since 1941.

Bond financing for urban expressways urged on western highway officials

Speaker urges revenue bonds to provide cash for traffic-easing work —Immediate federal-aid spending sought

Financing urban expressways by revenue bonds, with future gas tax receipts pledged as support, was suggested recently by L. I. Hewes, chief of the western headquarters of the Public Roads Administration. Dr. Hewes spoke before the 27th annual conference of the Western Association of State Highway Officials, held July 26-28 at Portland, Ore.

Stating that the urban traffic problem can be solved by construction of limited-access freeways, Dr. Hewes said that such construction is not readily available under the pay-as-you-go plan. Bond-issue financing, however, is "more feasible and practicable . . . than . . . increasing the gas tax by a fraction earmarked for urban expressways," he added.

In another address, D. C. Greer, Texas state highway engineer, urged that all available federal highway funds be spent as soon as possible on work now planned, so that appropriations will be voted by Congress two years hence.

Pointing out that the Federal Aid Highway Act of 1948 was opposed in Congress last June, since money made available in 1944 had not yet been spent, he urged that all states put federal funds to use without delay.

Suggestions for cost saving

Letting of projects on an "assembly-line" basis was suggested as one method of lowering highway costs by A. C. Clark, chief, construction division, PRA. Lower costs could be realized if one contractor did grading on several small projects located close together, another did surfacing and paving and a third did the structures. He also suggested that certain types of work can be performed more economically by day labor methods, and purchase of such commodities as steel by the states would take some of the uncertainties out of contracts.

Other speakers at the meeting included R. H. Baldock, Oregon state highway engineer and AASHO president, G. Donald Kennedy, vice-president, Automotive Safety Foundation; R. E. Dougherty, ASCE president; and F. W. Panhorst, California state bridge engineer.

Schedule $250 million 1949 reclamation work

Reclamation engineers and administrators outlined a budget of $250,000,000 in construction for the next twelve months at a meeting in Grand Lake, Colo., recently. The construction program is the largest in the 46-year history of the Bureau of Reclamation.

Big as it is, the program is smaller than the bureau wanted. After cutting to the bone its appropriation request, the bureau asked Congress for just under $278,000,000. Congress pared this request, but with a carryover of about $25,000,000 from fiscal 1948, reclamation has more than a quarter billion dollars to spend for construction in the current year.

Chief cuts by Congress struck out of the bureau's program certain transmission lines, switchyards and power facilities. These changes were in line with the dominant attitude of the 80th Congress in opposing extension of public power.

Some immediate benefits will come from the year's construction program. Commissioner Michael W. Straus said at the close of the Grand Lake meeting, "Our work schedules are pointed to bringing reclamation project water to 125,000 more acres this fiscal year and to making available 260,000 kw. of additional hydroelectric generating capacity during that period."

New York to receive bids on big road improvements

Bid proposals on highway construction totaling 75.36 miles at an estimated cost of $16,681,000 will be opened on Aug. 18 in the office of the New York State Superintendent of Public Works.

The largest single item of construction to be let will be the paving of more than 21 miles of the Taconic State Parkway at an estimated cost of nearly $5,000,000.

Delaware receives refund from highway department

Money advanced by the state of Delaware for the $40,000,000 Delaware River Memorial Bridge project south of Wilmington was returned to the state treasury recently.

A check for $125,000 was turned over to Governor Bacon by Frank V. duPont, chairman of the Delaware State Highway Department, under whose jurisdiction the Delaware River Crossing Division is operating. The department has sold a bond issue to cover the entire cost of the project.

The $125,000 represented the fund advanced by the state for preliminary work on the project. It was pointed out that this was one of the few instances on record where preliminary expenses for a large public project were not paid by the state, even though the main cost of the project is to be financed from other sources. The Delaware River crossing will be planned, financed, built and placed in operation with no funds from the state of Delaware's treasury.

States let $500 million road work

State highway departments placed more than half a billion dollars worth of road work under contract during the first six months of 1948. Reports received by the Public Roads Administration show that projects having a total construction cost of $568,091,000, for improvements on 21,714 miles of primary and secondary roads, were let to contract between January 1 and June 30.

Federal-aid projects involving work on 10,439 miles of road accounted for $346,788,000 of the total. The federal contribution amounted to $184,723,000.

Contracts awarded by state highway departments for work financed without federal assistance called for a total expenditure of $221,303,000 for improvements on 11,275 miles of road.

The projects included three bridge construction jobs for which contracts were awarded by special toll authorities, as follows: Delaware River Bridge, $11,401,000; Mystic River Bridge in Massachusetts, $13,282,000, and the Tacoma Narrows Bridge in the state of Washington, $11,197,000.

Pennsylvania, with a total of $71,359,000, led the states in the dollar-volume of contracts let in the six-month period. California was second with a total of $36,950,000, and Texas third with a total of $30,342,000.

In total mileage of road improvements contracted for, Texas was first with 2,400 miles; Ohio second, with 1,637 miles, and Pennsylvania third, with 1,208 miles.

Amplify points at issue in Kansas bridge dispute

A statement by an officer of the consulting engineering firm involved, relating to the recent unsuccessful attempt to arbitrate a contractor's claim for damages on the construction of new piers for the 12th Street Bridge over the Kansas River at Kansas City, Kan., last week called attention to possible erroneous interpretation of the original report.

The arbitration attempt failed when attorneys for the contractor—William J. Howard, Inc., of Chicago—and those for Wyandotte County, Kan., the owner, could not agree as to whether the arbitration should take place under terms of the contract or should proceed under terms of Kansas law providing for such matters.

The Howard company, contractor on the bridge for the county, asked damages exceeding $100,000 on the ground that there had been an error of 28 ft. in locating excavation for a cofferdam, and contended that the error was caused by the consulting engineers for the county—Sverdrup and Parcel of St. Louis—having given the erroneous initial points (*ENR* June 17,vol.p.988).

In a statement to *Engineering News Record*, Lief J. Sverdrup, president of the consulting engineering firm, sought to correct any implication that might be drawn from the June 17 article to the effect that both parties had agreed that the pier had been located 28 ft. in error. "Actually, this was the contention of the contractor," he said.

Mr. Sverdrup also pointed out that the contractor's original claim on the county was not rejected on the basis that it was the contractor's responsibility to locate the pier—as had been stated in the June 17 article—but rather that the engineering firm had refused to approve the claim because the contractor "had failed, in the engineers' opinion, to prove that he had been damaged."

CAA announces aid to airports for 1949

The Civil Aeronautics Administration last week announced additional federal-aid grants making a total of $45,229,007 for 389 grant offers.

Of these grants 108 are for work on Class 1 airports; 95 for class 2 fields; 110 for class 3; and 76 for development of class 4.

State or local sponsors will contribute $38,720,996 to the cost of projects, making the total available funds approximately $83,000,000.

Colorado basin states form compact

Upper basin states of the Colorado River have divided their share of the stream's annual flow. They will ratify a formal compact Oct. 6 at Santa Fe., N. M. The agreement on division of water was put in writing July 22 in Vernal, Utah, at a meeting of commissioners from the five upper basin-states.

By the agreement, 50,000 acre-ft. go annually to Arizona, and the remaining 7,450,000 acre-ft. available to the four other states: 51.75 percent to Colorado, 23 percent to Utah, 14 percent to Wyoming and 11.25 percent to New Mexico. The agreement assumes continued development under reclamation law of mainstream regulating storage reservoirs above Lee Ferry to assure to the lower basin the 75,000,000 acre-ft.

Several steps have to be taken before the upper basin compact becomes a full-fledged legal document. After formal signing, the agreement will be presented to the legislatures of the five states next January for their approval. Next, it will go to Congress to be ratified by the legislative branch of the federal government.

PERSPECTIVE . . . .

Industrial construction curve flattening?

This week the first signs of a break in the long-continued capital-expansion boom became apparent—but you had to look with a mighty sharp and jaundiced eye to see them. The signs, such as they are, are in this week's report from the Commerce Dept. and SEC on business expenditures for plant and equipment in the first, second, and third quarters of 1948.

No one has to read the figures pessimistically. They show that plant and equipment spending in the first quarter of 1948 was 32 percent ahead of the same quarter in 1947; scheduled spending in the second and third quarters is 19 percent and 10 percent respectively ahead of the corresponding quarters of last year.

But looked at in another way, the figures show a flattening out, an end to the steep rise which has been interrupted only once (in the first quarter of '47) since 1943. Perhaps this is the beginning of a turndown in capital expansion; perhaps it means that business expenditures are bumping against the capacity of the capital goods producers; perhaps it's merely a statistical vagary.

One other slightly ominous feature arises from the history of this statistical series. Two and a half years ago, Commerce and SEC began investigating business intentions on capital spending. Sample firms were asked what they had spent in the previous quarter, what they intended to spend in future quarters. Then the survey was repeated each three months. Thus for any quarter-year, the two agencies publish a first estimate of spending, a second estimate, and a final figure.

In the past, every time the investigators went back for another look they found that businessmen had upped their ideas on spending.

This week, for the first time, the new figures are lower than the original intentions. Take the first quarter of 1948, for instance: Expectation last fall was for total spending of $4.1 billion. Early this year, businessmen expected to spend more than that in the first quarter—a total of $4.5 billion. Actual spending amounted to only $4.2 billion.

Similarly, the latest estimate for the second quarter is down to $4.7 billion from a total of $4.8 billion scheduled for this quarter at the beginning of the year. In the second half of 1948, businessmen originally intended to spend $9.5 billion. They now look for $4.6 billion in the third quarter.

Continuing the trend of previous reports, this week's figures show that expansion of the manufacturing industries, though still the largest component, is declining in relative importance. Commercial expansion holds its own. Railroads are the only group which have increased their spending intentions.

Trend confirmed

The trend apparent in the SEC reports is confirmed in the statistics gathered by the *Engineering News-Record* business news department.

Although the current backlog for industrial building is $3,814,758,000—enough for four years of work at present rates— it is growing at a steadily slower rate.

During the first six months of 1948, $271,044,000 was added to this backlog, as compared with $326,000,000 in the last six months of 1947, and the peak of $815,686,000 in the first six months of 1947.

Random Lines *from an editor's notebook . . .*

. . . In which is a portrait of Ralph L. Parshall, whose invention is more widely known than its inventor

For more than two decades the Parshall Flume has been used widely by irrigators, sewage plant men and a host of others who are concerned with the problem of measuring flows in open channels.

Not nearly so well known is the civil engineer who developed it, Ralph L. Parshall, who recently retired from full-time activity as senior irrigation engineer of the U. S. Department of Agriculture.

Shunning the higher promotions and wide personal acclaim that moves to more populous centers might have brought him, Mr. Parshall has remained for almost 50 years at Fort Collins, Colo., a small college town in the midst of a heavily irrigated farming district. There, with characteristic devotion to the agricultural economy of the West, he has combined sound mastery of hydraulic principles with careful and inventive workmanship to produce a succession of practical contributions to irrigation engineering.

The story of the flume

It was in 1926 that Mr. Parshall first announced results of experiments he had conducted leading to the development of what he termed "an improved Venturi flume." By proposing this name, he acted in the tradition of another able hydraulician, Clemens Herschel, who had named his Venturi meter after Giovanni Battista Venturi, the 18th century scientist who performed the original experiments with tapering tubes. But engineers soon gave the device the distinctive recognition it deserved and began calling it the "Parshall Flume."

In talking about his flume, Mr. Parshall always is careful to credit V. M. Cone with the initial development steps. In 1914, Mr. Cone, who was Mr. Parshall's superior at the Fort Collins USDA station, commenced experiments on a tapering flume with vertical walls and a level bottom. The upstream walls converged to a foot-long throat, which connected them to diverging downstream walls.

The flow characteristics of the original Venturi flume were not wholly satisfactory for calibration purposes so, later, Mr. Parshall began experiments that led to a more perfect application of the law of discharge. The angles of convergence and divergence were narrowed to 11 deg. 19 min., and 9 deg. 28 min., respectively. The throat length was increased and the floor of the throat was given a downward slope. These improvements culminated in 1926. After verifying his new design he calibrated flumes in sizes from 6-in. to 8-ft. width, and published the results.

Since 1926 Mr. Parshall has carried the improvement of the flume along with numerous other projects, including snow surveys for forecasting spring runoff, stream gage instrument improvement and the perfection of canal desilting devices. One of his most recent inventions, the Vortex Tube, effectively removes bed-load sand and silt from irrigation ditches. His later work with flumes included design and calibration of structures from 3-in. to 40-ft. throat widths, design of metal flumes and of knockdown steel forms for concrete flumes.

Now in semi-retirement, but still serving as an official collaborator of the Department of Agriculture, Mr. Parshall carries on "business as usual." His base of operations is his old desk in the Colorado A & M College civil engineering building, but the visitor has no assurance of finding him there. He may be working patiently on experiments in the nearby Colorado hydraulic-laboratory building or at the USDA Bellevue outdoor laboratory, seven miles northwest of Fort Collins. Or he may be anywhere in the West, advising on irrigation problems, for his counsel constantly is sought by the engineers who know and respect him.

When quizzed closely, Mr. Parshall will admit semi-retirement gives him a little more time to tinker around the home he has occupied since 1907, and also to engage in a recently-adopted hobby—painting.

At the easel he finds that he can express a feeling for the West which he could not express in his meticulous and unassuming English. This feeling for the West, a true love, may explain the fact that he never attempted to follow the star of the Parshall flume, beyond irrigation and into ever-broadening civil engineering and industrial recognition. —*R.H.D.*

Synthetic fuel plant locations considered

The Corps of Engineers has started a $1,500,000 nationwide survey to determine best locations for synthetic fuel plants. First move in the program, undertaken for the Army, was the award of a contract to Ford, Bacon & Davis, New York consulting engineers, to make a pilot survey of three regions.

These areas are western Kentucky (coal), northwestern Colorado (oil shale) and southeast Texas (gas). Upon completion of this survey, the Corps of Engineers hopes to start the coast-to-coast job, covering remaining areas where coal, oil shale and gas are available.

The Bureau of Mines requested the Army to make the survey. It set up the specifications as to the fuels, processes and plant requirements.

Announcing the survey, the Army stated that an additional 2,000,000 bbl. of oil daily would be required for civilian and military needs in this country in the event of an emergency of the magnitude of World War II. Present consumption is 5,500,000 bbl a day.

Road builders' committee doubtful of savings in contracting county work

Advantages seen in close cooperation between county and state in federal-aid work as officials discuss county problems

Wide divergence of opinion as to possible savings in the cost of doing county highway work by contract was found by a committee of the County Highway Officials' Division, which reported to the division meeting at the ARBA Road Show in Chicago, July 16-24.

This meeting was one of several technical sessions held during the show, which was reported in part in last week's *Engineering News-Record*.

Earl J. Mattis of Massena, St. Lawrence County, N. Y. who was chairman of the county officials committee, said that some counties reported savings only on large jobs, others reported higher costs for practically all work done by contract instead of with the county's own forces. There appeared to be a quite general belief that normal work can best be done with a county's own forces; and many county engineers expressed resentment over the impression created by the advocates of contract work that, in general, all work by county forces is inefficient.

A new committee on maintenance, headed by A. O. Cuthbert, engineer-director, County Road Association of Michigan recommended the breaking down of county road costs into (1) maintenance of the basic structure, and (2) readiness to serve and special service functions. Into the second division would go the cost of special equipment such as snowplows and ditchers not used 12 months in the year. General use of this or some similar division was recommended as a means for making maintenance costs easily comparable.

Federal-aid for counties

In a report on federal-aid for county work, Otto S. Hess, Kent County Road Commission, Grand Rapids, Mich., emphasized the advantages of the closest possible cooperation with state highway departments in handling this type of work.

Somewhat similar recommendations were made by W. M. Biays, president of the Kansas County Engineers' Association, in discussing possible economies in designing bridges for county work, and by Paul B. Rynning, county engineer, Jackson County, Medford, Ore., in a report on standard for county work. Mr. Rynning's committee favored adoption of the standards proposed by the consulting board set up by the Public Roads Administration, which are flexible enough to cover nearly all secondary highway work.

Two-way radio telephone

H. A. Radzikowski, maintenance engineer of the PRA, advised both the county and municipal division meetings that 24 frequencies were assigned to state, county and municipal highway departments about two weeks ago by the Federal Communications Commission for two-way radio telephones. This puts those departments on a par with police and fire departments. Mr. Radzikowski urged the county and municipal officials to apply for an assignment of a frequency band even though they may not be able to make an installation at this time. All applications are to be cleared through the AASHO Committee on Use of Radio in Highway Departments, of which he is secretary and Warren K. Myers, maintenance engineer, Pennsylvania Highway Department, is chairman. This committee will cooperate with the FCC in arranging assignments that will minimize conflicts.

In commenting on this subject, Ray Traver, county engineer, Onondaga County, Syracuse, N. Y., said that their installation of two-way radio had paid for itself last winter during the bad storms through time saved for the department's snow handling equipment and for help to stranded vehicles.

Jet plane damage to runways

Damage to airport runways resulting from the operation of jet planes came up for active discussion in the airport committee meeting. S. E. Matullo, of the Bureau of Yards and Docks, Department of Navy, said that the bureau has been studying this subject and hopes to have a report ready soon. In its jet planes the Navy uses 80 octane gasoline instead of kerosene, which is used in Army planes. Mr. Matullo said that there is spillage when ignition is delayed in attempting to start a jet plane.

Bituminous pavements are damaged by this spillage, and bituminous fillers in the joints of concrete pavements also are injured.

Heat from the jet does not appear to be an important factor, for although the temperature at the jet outlet is around 800 deg., the jet is horizontal and temperatures at the pavement surface do not exceed 200 deg.

Phillips Moore, director, Airport Engineering Service, Civil Aeronautics Authority, said that the Army also has been making extensive tests on damage to runways and to joint fillers. These appear to show that a topping of coal tar will protect pavements in which asphalt is used as a binder.

Also discussed was a possible reduction in the number of runways required for airports because of the widespread adoption of caster-type landing gear. On this subject, Mr. Moore said that the CAA is so convinced that this type will be in general use within the next five or six years that it is urging the builders of new fields to limit their runways to two. With this type of landing gear a plane can land without regard to the wind direction.

Discuss municipal work

A committee report to the Municipal Division detailed a broad system of property assessment for street improvements. Presented as a guide toward the establishment of a more uniform

(*Continued on next page*)

To discuss Alaska's $65 million program

The District Engineer, Alaska District, will hold a series of meetings in different parts of the country for the purpose of acquainting contractors with the $65,000,000 program proposed for completion in the next year and a half.

Col. W. E. Potter in holding these conferences will also stress the need for engineers in all grades up to and including P-5 in Alaska at regular civil service rates plus 25 percent.

The itinerary is: Aug. 20, at Seattle; Aug 23, Kansas City; Aug. 24, Chicago; Aug. 26 New York; Aug. 28, Denver. Work under discussion will be advertised between next September and next February.

Apprentices on job reach all-time high

Apprentices employed in the construction industry reached an all-time high of 132,114 on July 1, an increase of 32,000 over the same date a year ago, the Bureau of Apprenticeship, U. S. Department of Labor, reported last week.

The July 1 total was compiled from 6,959 reports from all parts of the country but does not represent complete coverage.

California retained the lead with 19,974 construction trades apprentices, followed by New York with 11,620.

Ohio recorded 9,578. Of the major craft groups, the woodworking trades had 47,215 men.

assessment policy, the report included the recommendation that legislation be fostered to compel private builders and developers to construct their street improvements in accordance with municipal standards.

A traffic committee report based on a survey of 55 cities indicated that 82 percent believe that their traffic congestion was adversely affecting business. Two reporting cities felt that the problem was so acute that they suggested the prohibition of all passenger vehicles from the central business district. In general, it was felt that a practical solution could be reached by increasing the traffic-carrying capacity of streets through the elimination of curb-parking and by providing off-street parking facilities.

Wage rates unsettled

Payroll difficulties and increased construction by state maintenance forces were the chief subjects of discussion at a meeting of the Contractors' Division. Fear was expressed by Taylor G. Soper, executive-secretary, Illinois Contractors Association, as to the effect on the construction industry of a U. S. Supreme Court ruling last month relative to basic wage rates for longshoremen on the West Coast.

This decision, in effect, ruled that both premium and overtime payments must be included in total weekly earnings in establishing the hourly rate for workmen. If such a ruling is applied to the highway construction industry, warned Mr. Soper, it will play havoc with the contractor's payroll. Basic hourly rates would vary from week to week. Moreover, the various rates could not be calculated and payrolls could not be made up until the work-week was completed.

Consensus of the contractors' group was that relief can come only from legislative action clarifying the application of such a method of establishing hourly wage rates. Burton G. Miller, manager of the Contractors' Division of ARBA, pointed out that although the Wages and Hours Division of the Department of Labor has set Sept. 15 as the effective date of putting the Supreme Court's decision into operation, it is entirely possible that if and when the ruling is applied to the construction industry, it may be made retroactive to June 7, 1948 the date of the court's decision.

The contractors' group also expressed disapproval of the U. S. Supreme Court's recent ruling relative to pricing of cement. It was thought that this ruling could give rise to chaotic conditions throughout the country under which contractors will be unable to prepare definite contract bids because of the indefinite prices of cement.

ALSO RECORDED. . . .

Plumbing became a concern of road-builders at Yellowstone National Park recently. A steam vent developed in the center of a road near Nymph Lake. Park repair crews spent a day installing piping to take the steam to the roadside before they could repair the hole.

Sidewalk - superintendent notes: In Billings, Mont, a contractor installed a covered 24 x 10 ft. grandstand, 10 ft. high, so that construction of a huge oil refinery can be viewed in comfort. Special, engraved "diplomas" are issued to spectators by the Quick-Way Truck Shovel Co. at the site of its new building in Denver, Colo.

Tired of streets so badly rutted they were barely passable, residents of Alexandria, Ind., closed up their town for a day and went to work. Factory workers, bankers, ministers and businessmen spent a day placing and smoothing asphalt delivered by trucks loaned by the business firms.

Nature Notes: Wisconsin beavers were declared by the state's attorney general to have a legal right to build their dams without reference to the laws of local government. A nest of robins on a tree in the exact center of a building site at Two Rivers, Wis., forced a change in construction plans for a theater—the contractor agreeing to build around the tree until the young birds could fly.

North Dakota highway officials somewhat ruefully contemplated the possibilities of their state's $83 share of a $20,000,000 federal fund for highway building in national forests. The funds are apportioned on the basis of acreage within a state—and North Dakota has only 520 acres of national park land. "The money should build us a fine fence post," commented Highway Commissioner N. O. Jones.

Michael Straus, who will be ineligible as Commissioner of Reclamation under terms of a new law because he holds no engineering degree, could boast some recognition last week. On the occasion of a Straus visit to the site of Hungry Horse Dam, Blackfeet Indians commissioned him "Engineer of the Wilderness."

Interest in compaction tools

One of the other technical sessions noteworthy for attendance and general interest was that devoted to compaction of soils. Five papers were presented covering the selection and gradation of granular backfill, uniformity of sheepsfoot roller specifications, and compaction of soils by pneumatic tired rollers, gasoline rammers and vibrating rubber tired rollers.

Exhaustive gradation and compaction studies conducted recently in Michigan prove that up to 20 percent settlement can and does occur on embankments or backfills having little or no consolidation at the time of construction. This was one of the conclusions of a paper presented by Roy L. Greenman, assistant engineer of soils, Michigan State Highway Department. Other conclusions indicate the necessity of using properly graded materials, with thorough compaction. An illustrated article on the Michigan soils investigation, including the development of compaction equipment, has been prepared by Mr. Greenman for publication soon in *Engineering News-Record*.

Emphasizing the need for uniformity in design requirements for sheepsfoot rollers, A. O. Williamson, product engineer, Wm. Bros Boiler & Manufacturing Co., Minneapolis, Minn., declared that two standard size rollers could be developed which would meet compaction requirements for all types of earthwork.

The larger roller—for heavy freeway construction, major airports and large embankments—should be 5 ft. in diameter, 5 ft. wide with 112 tamping feet in four rows; 28 feet in each row. Tamping feet should be 9½ in. long, containing 7-sq. in. of tamping area. When empty, such a roller should weigh about 20,000 lb. to give a tamping pressure of 350 psi. When loaded to a gross weight of 42,000 lb. it would develop 700 psi. pressure.

The junior size roller, recommended by Mr. Williamson, would be 40-in. dia., and 4 ft. wide. It should have 112 tamping feet, 7 in. long with 6 sq. in. of tamping area, mounted in four rows; 28 in each row. Such a roller should weigh 6,000 lb. when empty to give 125 psi. pressure. When loaded to 14,000 lb. gross weight, it would develop a maximum tamping pressure of 300 psi.

Simplification of design specifications for sheepsfoot rollers would benefit the manufacturer, the distributor, the contractor, the engineer and the tax-paying public in many ways, concluded Mr. Williamson.

OBITUARY

Don G. Savage, 50, vice-president of the Thew Shovel Co., died July 25 in Lorain, Ohio. An authority on power shovels and cranes, Mr. Savage had been a Thew employee for 28 years. Prior to his promotion to vice-president July 15, he had served as general sales manager since 1935. He attended Baldwin-Wallace College in Cleveland.

James P. Donovan 59, Commissioner of public works for Quincy, Mass., died July 21. Before becoming head of the works bureau, he was commissioner of streets.

Col. John C. Bohan, 58, engineer, who built important buildings in Chicago, Ill., died there July 27. He served actively in both world wars.

James P. Anderson, 52, long a resident of Kansas City, Mo., died there July 18. He was a civil engineer and operated Anderson Surveying Co. with his two sons.

Vernon L. Woodring, 62, paving engineer for the engineering department of Minneapolis, Minn., died there recently.

Emmett R. Sweeney, 81, who was former superintendent of state highways for the Painesville, Ohio, district, died July 26.

Grant M. Cook, 57, former Youngstown, Ohio, city engineer (1932-36) died July 26. He went to Youngstown in 1913 as engineer for the Truscon Steel Co., after graduation from the University of Toronto. During World War I he served with the 472nd Engineers.

Chester Harritt, 72, general manager and chief engineer of the La Mesa-Lemon Grove-Spring Valley Irrigation District, in San Diego County, Calif., died July 19. He had been associated with the district for over 39 years, mostly as engineering and operating head. In 1909, he entered the employ of the San Diego Flume Co., forerunner of the irrigation district.

Homer L. Freehafer, 67, retired engineer, died July 17 at Phoenix, Ariz. He had worked 32 years at Denver, Colo. for the Mountain States Telephone and Telegraph Co., having retired in 1937.

Jesse William McCune, 60, for 25 years an engineer on federal building construction work in the western states, died July 25 at Billings, Mont. At the time of his death, he was an engineer for the Barry O'Leary Construction Co. of Billings. He was graduated from Iowa University as a civil engineer in 1912. For 25 years he was an engineer with the W. P. Lovell Construction Co.

George M. Weimer, 66, associate professor of the humanities and secretary of the faculty at Stevens Institute of Technology, Hoboken, N. J., died July 28. He had been on the faculty for more than 30 years.

William P. Wren, 51, deputy chief engineer of the New York City Board of Estimate and with the board for 26 years, died at Southhampton, N. Y., July 26.

Alexander C. MacKenzie, 98, died July 24, at Bedford, N. S. He had been in general contracting about 40 years, and had been active in the construction of the Nova Scotia Technical College, and Dalhousie University at Halifax.

Sees $5 billion cost of Columbia flood dams

The construction of enough dams and reservoirs to control floods of the Columbia river to any appreciable extent would cost $5,000,000,000, Maj. Gen. Thomas M. Robbins (Ret.), former assistant chief of army engineers, said recently.

General Robbins was the Corps of Engineer's Portland district engineer in 1937.

Explaining that neither Bonneville nor Grand Coulee dam were designed for flood control, General Robbins said it would take "at least 20,000,000 acre-ft. of storage" to have any effect on the flood crest.

MAJOR MEETINGS

American Water Works Association, Kentucky-Tennessee Section meeting at Patton Hotel, Chattanooga, Tenn., Aug. 23-25.

Regional Surveying Teachers Conference, Green Engineering Camp, Ringwood, N. J., Aug. 26-28.

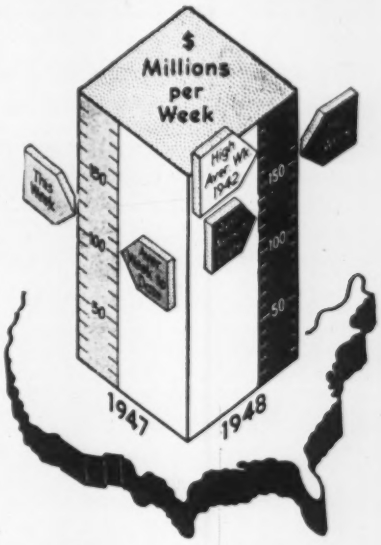
National Council of State Boards of Engineering Examiners, annual meeting, Hotel Utah, Salt Lake City, Utah, Aug. 26-28.

American Water Works Association, Minnesota Section at Royal Alexandra Hotel, Winnipeg, Man., Canada, Sept. 1-2.

The International Society for Photogrammetry, Sixth International Photogrammetry Congress and Exhibit, The Hague, Netherlands, Sept. 1-10.

Canadian Good Roads Association, annual convention, at Digby, N. S., Sept. 7-9.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of August 5 1948	Cumulative 1948 (32 wks.)	Cumulative 1947 (32 wks.)
Federal	$22,099	$624,148	$425,255
State & Mun.	65,684	1,528,858	1,038,917
Total Public	$87,783	$2,153,006	$1,464,172
Total Private	65,811	2,047,676	1,843,699
U. S. Total	**$153,594**	**$4,200,682**	**$3,307,871**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (32 wks.)	Cumulative 1947 (32 wks.)
Waterworks	$11,688	$122,433	$67,700
Sewerage	5,263	132,835	80,566
Bridges	9,805	182,472	106,279
Highways	17,189	612,445	495,341
Earthwork, Waterways	4,852	305,198	194,127
Buildings,			
Public	37,038	670,281	351,196
Industrial	12,367	592,998	495,147
Commercial	39,420	1,193,243	1,082,062
Unclassified	15,972	390,777	435,453

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (32 wks.)	Cumulative 1947 (32 wks.)
NON-FEDERAL	$3,161,044	$1,483,035
Corporate Securities	1,612,898	517,486
State and Municipal	1,120,857	717,838
Fed. Aid Highway	427,289	247,711
FEDERAL	1,558,932	818,729
Total Capital	**4,719,976**	**2,301,764**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Aug't '48	475.51	228.58
Building Cost	Aug't '48	555.45	192.15
Volume	July '48	213.	93.

EDITORIALS

VOLUME 141 NUMBER 6

August 5, 1948

Tunneling Safety

TUNNEL DRIVING is hazardous under the best of conditions, and seldom do ideal conditions prevail on underground work. To make tunneling as safe as humanly possible is a combined responsibility of both the engineer and the contractor. Preparing specifications that include general safety clauses and call attention to existing blanket safety codes does not discharge the engineer's responsibility. He must further insure that all safety precautions are followed, and also provide instructions to cope with special hazards that may develop in the course of the work. Engineers on Cleveland's $6,000,000 Nottingham water intake (described on p. 76) are to be commended for foreseeing gas hazards known to exist from previous experience in this area and for specifying employment of a full-time safety engineer equipped with gas-detection apparatus. Contractors must bear an even greater share of responsibility because their experience makes them far more familiar with hazards and potential accident risks. They should not hesitate to recommend and go beyond specified requirements where, in their judgment, such action would promote safety. And engineers would be well advised to encourage such an attitude. To keep tunneling safe it is necessary to use the combined efforts, knowledge and vigilance of all concerned.

Outfall Joint Design

JOINTS are of first importance in design and construction of ocean outfalls. This is emphasized in two articles on sewer-outfall construction in southern California, one reporting on the outfall for the Los Angeles County Sanitation Districts (*ENR*, Mar. 4, vol. p. 368) and the other in this issue referring to a project for the city of Los Angeles. That different methods were employed for solution of the joint problem is understandable because site conditions differ. Not only do the physical characteristics vary, but the previous experience with outfalls at identical locations also shows wide variation in performance. The county, on an earlier installation, paid particular attention to joints and this experience was used to good advantage in the new design. On the other hand, the original city outfall had weak joints that opened up soon after the job was finished. Consequently, it is understandable why the city's present design is conservative by being practically jointless. A leak-proof, criticism-proof outfall is a "must" for the city, even if the cost is disproportionately high. In both cases, engineering judgment was guided by local experience, the importance of which can never be underestimated as a basis for design.

Maintaining Highways for Safety

LONG-RANGE PLANS for reducing highway accidents through more rigid enforcement of traffic laws, education of the motorist, better traffic control, and the incorporation of greater safety in the design on new highways promises much for the ultimate reduction of our highway-accident toll. But the immediate need for safety measures was all too pointedly emphasized in the Fourth-of-July holiday when traffic fatalities occurred at the rate of one every 15 minutes during these three days. With summer highway use at its peak every effort must be made to promote highway safety. This offers a challenge to highway maintenance engineers. They can do much to minimize hazards in outmoded and inadequate highway facilities. For instance, stricter enforcement of the "no-poster" regulations on right-of-way is urgently needed. And greater vigilance should be directed toward maintaining road shoulders flush with pavements, thus eliminating a major hazard to high-speed traffic on narrow roads. Mile-by-mile inspection will reveal a host of things to facilitate traffic movement, such as repainting of line markings and faded directional signs. Individually, the part played by highway maintenance engineers in eliminating traffic hazards may not appear to be much, but collectively these efforts assume great significance.

Maximum Water Development

LATE RAINS this spring that averted an immediate and critical water shortage in California did not change the long-range aspect of the situation that exists in this area. The danger of insufficient water still threatens. Wet and dry seasons come and go, but California's population trend seems always to be upward. With a 43 percent increase of population since 1940 it is natural that the demand on the state's available water supplies has greatly increased, perhaps to the point of frequently being critical in relatively dry areas. Only in a region

of heavy rainfall can development go on indefinitely without concern for increased water demands. In areas of scanty rainfall, ultimately the question becomes how much population or irrigated land can be supported on the amount of water available. The immediate question in California now is how to develop the state's water resources to the economic maximum.

A Half Century of Service

THIS YEAR the American Railway Engineering Association celebrates its 50th anniversary. It is unique among engineering organizations in its method of functioning and in the limitations placed on its membership. These peculiar characteristics have been both an asset and a handicap.

Membership in the AREA until quite recently was closely restricted to actual employees or officers of a railroad. This had the effect of making the AREA an agency of the railroads and probably accounts for the large amount of time that the railroads have permitted their engineers to give to work of the association and for the wide acceptance of the standards it has developed. On the other hand, this restriction has limited the size of the association and probably has deprived it of the services of men who would have been an asset. The ultra-conservatism that has characterized the railroads for years is clearly reflected in the AREA.

The AREA has functioned almost entirely through the medium of standing committees on such subjects as track, rail and buildings that over the years have increased to about 20 in number. Subjects for study are assigned to these committees by the board of direction, frequently on a recommendation from the committee to which the subject subsequently is assigned.

As a result of this system, the end products of the association's activities show much more evidence of logical planning than is the case of most technical societies where individual members submit papers on any subject within the society's fields of interest. Among the few exceptions to this general rule are some notable papers, which would indicate that railroad engineering might benefit by more encouragement to special studies by individuals in the future.

Principal end-product of the association's activity is the AREA Manual, a large book published in loose-leaf form so that it can be brought up to date annually. It is the "bible" of the maintenance and construction departments of the railroads of this continent.

Originally, the AREA was an independent association, but now it is the Engineering Division of the Association of American Railroads, which organization finances the large research program carried forward continuously by the AREA. That program has risen from $78,000 in 1938 to $292,000 for 1948, of which almost $80,000 is for the association's impact studies. This latter program, which was begun before the war, promises to be as productive of fundamental knowledge as were the association's classic studies of stresses in railway track and in rails, which were inaugurated under the resourceful leadership of the late Arthur N. Talbot.

Also worthy of special note is the AREA research into the cause and correction of rail failures due to transverse fissures, a study to which the rail manufacturers contributed liberally. Out of those studies came improved manufacturing processes that have greatly reduced the number of fissures, also the Sperry detector car, which now is widely used to discover incipient fissures in track before they become dangerous.

Along with the railroad companies the AREA has suffered as a result of the ending of the expansion of railways that began about the turn of the century, from banker domination of railroad planning, and, more recently, from truck competition. No longer is railroad engineering a field of adventure for young men or an outlet for initiative. Too few young engineers seek a career in railroad work. But, fortunately, both railroad management and the AREA now are fully aware of that fact and are attempting to do something about it. The AREA is seeking members among the few young men who are in railway engineering work and is making a definite effort to give them more active participation in committee work. Its expanding research program offers many opportunities for initiative, although as yet it has done little toward exploring the possibilities of newer construction materials or departures from tradition in railroad structures. The years ahead can be as fruitful as the half-century that is closing.

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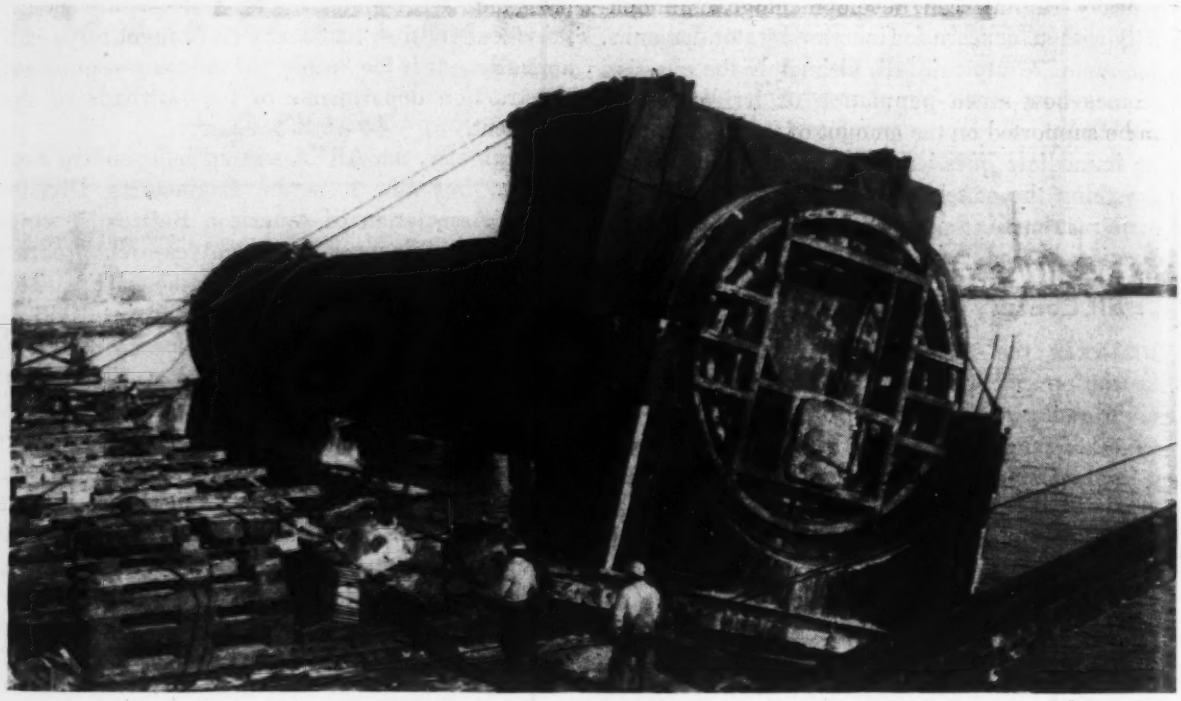


FIG. 1. A 455-TON OUTFALL SEWER section slides into Long Beach harbor waters. Bulkheaded ends and flotation tank aid buoyancy.

Outfall Has Precast Units 100 Ft. Long

TO PREVENT LEAKAGE, many precautions were taken in the design and construction of a mile-long, 12-ft. dia. outfall sewer for the city of Los Angeles. One of these was casting the offshore end in 100-ft. lengths which weighed 455 tons. The resulting reduction in the number of joints minimized the opportunities for leakage, and as a further precaution, rubber gaskets were used to seal joints and a collar of tremie concrete was poured over the joint as a further seal.

The inshore section of the outfall—2,080 ft. long—consisted of 12-ft. lengths of 12-ft. dia. pipe placed in a trench protected by steel sheet-piling. This pipe was placed on a 6-ft. thick concrete mat supported on H-piles and was completely encased in tremie concrete to assure immobility.

The precautions taken to obtain a leakproof outfall were prompted by experience with an outfall built some 20 years ago (*ENR* Aug. 20, 1925 vol. p. 929) that leaked almost as soon as placed. This outfall, located 1,000 ft. north of the new outfall, had no footings or collars. When the contributory population became great enough, contamination that occurred resulted in quarantine of some 11 miles of southern California beaches (*ENR* Dec. 11, 1947, vol. p. 790).

Outfall precedes plant

The outfall is part of a $30,000,000 program of sewage-treatment facilities that centers around a 245-mgd. capacity high-rate, activated-sludge plant (*ENR* May 29, 1947, vol. p. 874). However, primary-treatment facilities of this plant are not expected to be completed until sometime in 1949 or 50. The outfall will be placed in operation when it is completed late this spring. It is hoped that considerable reduction in beach contamination will result.

A recent outfall sewer built by the Los Angeles County Sanitation Districts (*ENR* March 4, 1948, vol. p. 368) varies considerably in design from the one being built at Hyperion even though both are about the same length. For one thing, slope of the ocean bottom at Hyperion is flatter and the line is subject to greater wave and current action. Larger flow at Hyperion requires a larger pipe. Furthermore, the previous poor experience of the city at this location prompted caution in the new design. Consideration of these and other factors led to the adoption of a heavy, rigid outfall.

Primary units of this outfall are 32 sections, each 100 ft. long with walls 14 in. thick. At the bell end there is a collar on the bottom half which extends 4¼ ft. below the pipe. This collar is placed on a footing on the ocean floor so that the sections are supported with a 5-ft. clearance between the pipe and the ocean floor level. Scouring action of ocean currents is not expected to have an appreciable effect as these sections are all placed at a depth of more than 20 ft. Discharge of sewage is provided by side ports in the last three sections as well as through the

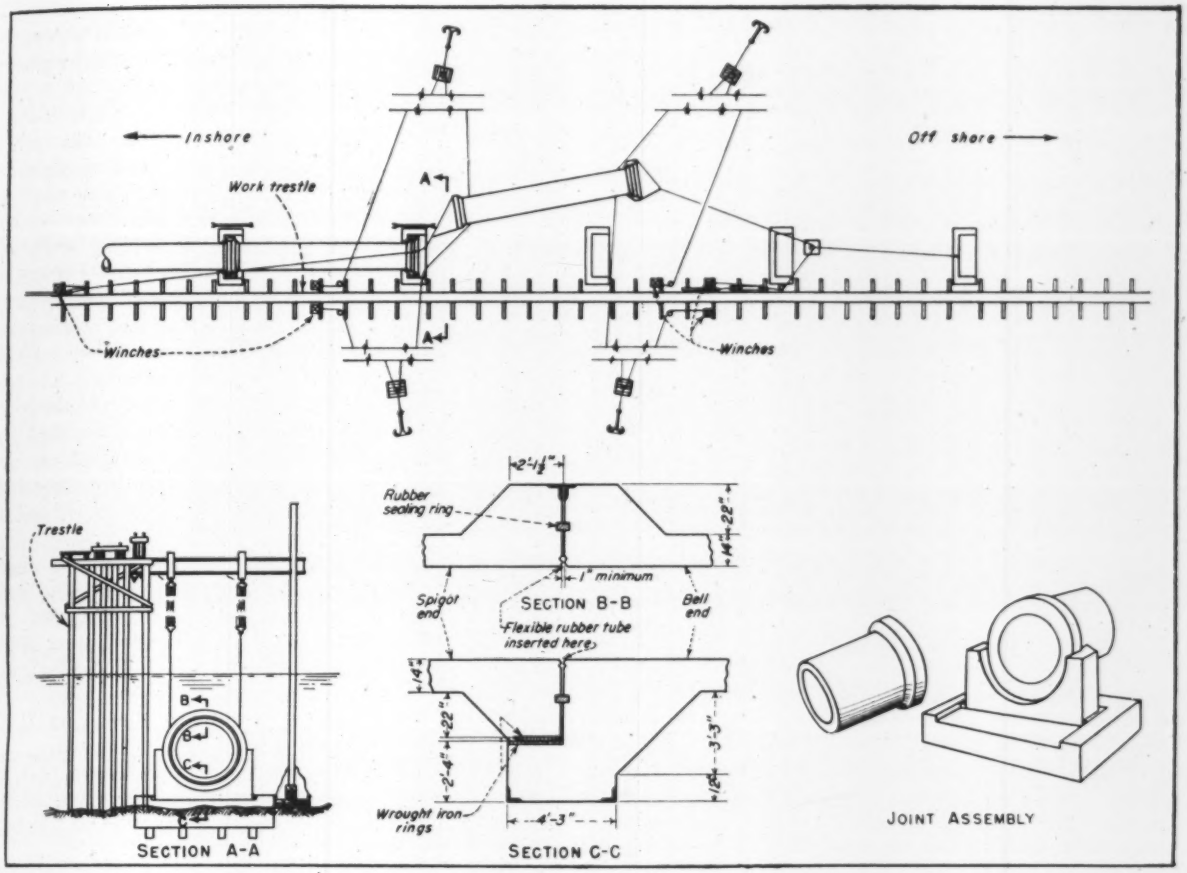


FIG. 2. TO SET THE 100-FT. LENGTHS in position handling lines were arranged as shown. Final position was obtained through the use of two hoisting towers (Section AA). Special attention was given joint design.

partly sealed end of the last section.

Because these pipes are supported at the ends, they are heavily reinforced.

Joint has two rubber gaskets

The major design consideration was to provide leakproof joints. To help prevent leakage, the 100-ft. lengths were provided with two rubber gaskets. One of these, 3 x 12 in. in section, was cast in the bell end of the pipe with 8 in. of it extending from the face of the joint. When a pipe is being seated, this gasket is inserted in a groove with a tapered opening on the spigot end of the joint. It thus is compressed to some 11 in. instead of the original 12 in. In final position, the joint faces are one in. apart.

The other gasket consists of a rubber hose about 3 in. in diameter which is compressed by a diver and forced into a groove near the inside of the pipe. Primary purpose of this inside gasket is to prevent sewage from entering the joint. It affords additional protection against leakage.

As a further aid in making a watertight joint, half-rings of wrought iron are cast on the bottom half of both bell and spigot joints. This armor is intended to prevent spalling during seating operations and any subsequent pipe movement. Spalling of concrete at joints was one of the prime causes of leakage in the old line.

Seating of the spigot end on the bell cradle is made easier as the half-ring on the spigot end is slightly convex and the one on the cradle is flat. Beside easing the final closure, these half-rings assure a uniform shape and a perfect watertight fit of this portion of the joint.

To anchor and seal the joints further, a concrete collar was poured over them after the pipe had been placed, that being the final step in construction. This collar was allowed to bond to the bell end but steps were taken to prevent bonding to the spigot end. This was considered important by city engineers as it will permit some movement in case of settlement of a footing.

A 1-in. thick sheet of asphaltic felt paper was used on the outer face of the spigot end for initial collar pours to prevent bonding. However, this proved difficult to cement on and the turned-up edges interfered with the proper placing of the tremie concrete. Substitution of some asphaltic or grease material applicable under water is being considered.

The large sections were fabricated by means of assembly line methods. Two sets of ways like those used in shipyard work were constructed at Long Beach harbor where launching depth was available. Each way accommodated four sections. Construction started first on the section nearest the water and proceeded to the other three. When a section was completed and cured, it was launched and the other three sections then moved toward the water, leaving a free berth to

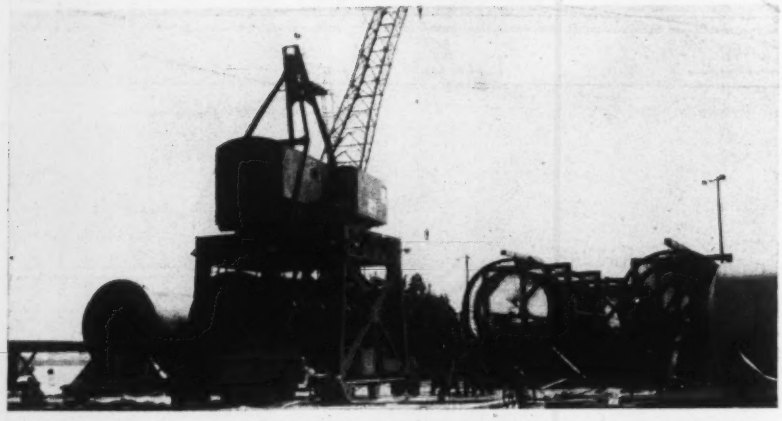


FIG. 3. SHIPYARD-LIKE PRODUCTION METHODS were used to produce 32 100-ft. lengths of pipe. A finished length just prior to launching can be seen at left. Adjacent to it is a length being poured.

FIG. 4. THIS FORM WAS USED for the concrete collar around the joints of the 100-ft. sections. After the concrete had set, the form was easily disassembled under water by a diver by using the wrench shown.

start work on a new section. In this manner the 32 sections required were constructed.

Cranes similar to those used in the shipyards were employed for setting reinforcing steel and pouring concrete. Steel forms were used both inside and outside. Because of the maze of reinforcing bars, vibration of the forms was necessary. Accordingly, external vibration was used with nine vibrators on the outside of the forms and nine on the inside during the 8-hr. pour of the 220 cu.yd. of concrete required for each section. There were some 90 spots on the forms to clamp the vibrators. Because of the necessity of frequently changing location of vibrators, a crew of twelve men was required for pouring.

Launching the pipe sections was also a shipyard-like job. Bulkheads were placed at each end of the pipe so the pipe's buoyancy would help support it in the water. A flotation tank curved to fit the pipe was mounted on top of it at the bell end so extra buoyancy would be available to offset the additional weight of the collar while the sections were being towed 30 miles to the job.

Pipe sections were skidded on the ways to a launching platform. This platform consisted of a hinged support or ramp for each end of the pipe. The outer end of this support was held by cables. After the pipe section was on this hinged support, the outer ends of the ramps were lowered, the pipe being held in place. Then the pipe was allowed to skid down the greased ways until it was self-supporting in the water.

The bell end of the 100-ft. lengths was cast with a special collar on the bottom half which when placed fit a key in a foundation pad cast on some twelve 14-in. H piles. This foundation pad was constructed with the aid of a caisson-like form. Leeway of some 3 or 4 in. was allowed in placing the form as the only portion required to be accurately located was the key. An air ejector was used to excavate sand from inside of the form until the form and sand reached the required depth. Into this form was placed a form for the key shaped to receive the collar on the bell end of the pipe.

Concrete was poured into these forms by tremies. Quantities of concrete required were computed by knowing the level of the bottom of the form and the required level of the top. This much concrete was poured and the elevation of the top was later checked by a diver. The top of the foundation pad was allowed to vary a few inches as long as it was 12 in. higher than the elevation of the key.

Handling pipe under water

Handling a 455-ton dead weight on land is a difficult job. Handling it in the water when subjected to the vagaries of wave and current was even more difficult. Actually, the underwater weight of the pipe was only some 270 tons. The pipe section was towed to approximate position, lines fastened to it, and after the flotation tank had been released, the pipe was snaked into position by lines as shown by Fig. 2. Then, by gradually filling it with water, it was lowered into correct alignment but lacking 5 ft. of closure. A concrete block in the form of a saddle laid on the ocean bottom held the spigot end at approximate elevation. The handling lines were protected from the effects of sudden movement by shock absorbers in the anchor system.

In final positioning, two movable towers similar to that shown in Section A-A of Fig. 2 were used. One was attached to each end after the pipe section had been set on the bottom. Two twelve-part falls were used to lift each end and the section was pulled by an onshore winch into final position. Power for the tower falls

was provided by locomotive cranes.

Normal operations called for two days to set one section. The 30 miles from Long Beach harbor was an overnight tow. The pipe arrived in the morning and was set on the bottom. Moving the tower usually took the rest of that shift. Final setting was completed during the next working day. Several sections were placed in one day by working two shifts.

After the long sections were seated, a concrete collar was poured over the top half of the joint to insure watertightness. Steel forms for this collar were assembled on the beach, brought out on the job trestle and set. After the pour had time to set up, forms were stripped by means of bolts which were easily removed by a diver using a special wrench.

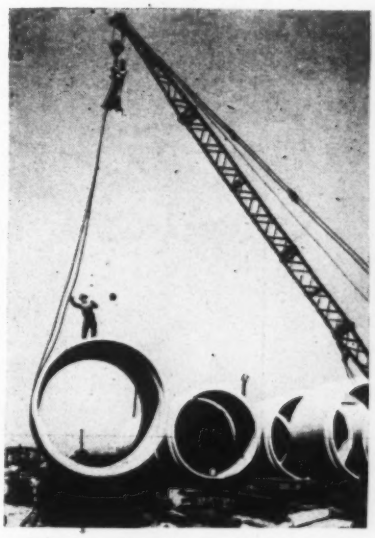


FIG. 5. INSHORE END of the outfall consisted of 12-ft. lengths of 12-ft. dia. pipe with plain bell and spigot ends.

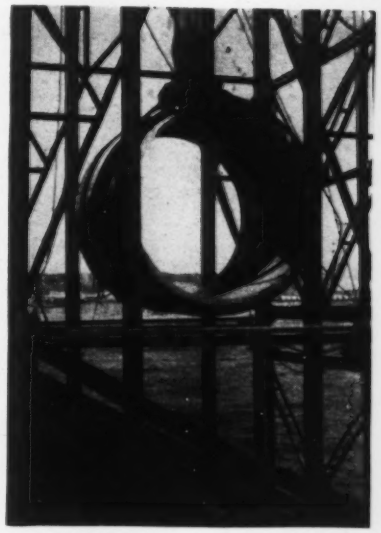


FIG. 6. SHORTER PIPE was placed by a three-legged gantry. Two legs rode trestle and one the piling.

FIG. 7. TWO OF THESE SADDLE SUPPORTS were used in placing each of the 12-ft. lengths. They were placed at each end of a pipe section in a keyway cast in the concrete supporting platforms.

Inshore end laid in trench

The first 2,080 ft. of the outfall sewer was constructed of 12-ft. lengths of 12-ft. dia. precast reinforced-concrete pipe. This pipe had plain bell-and-spigot type joints with watertightness being insured by a reinforced tremie-concrete seal completely encasing the pipe. It was laid on a concrete mat 6 ft. thick that in turn was supported by bents consisting of five 14-in. H piles. These piles were 30 or 40 ft. long and the bents were spaced 6 to 8 ft. apart depending upon location in the line. No pile support was required for the first 500 ft. of the line because adequate rock foundation was available.

A cofferdam of two rows of sheetpiling 20 ft. apart was provided for construcing the inshore end of the outfall sewer. After construction was finished, the sheetpiling was removed except for the first 700 ft. of the north side of the cofferdam which was left in place to serve as a groin to help in the program of building up the beaches. When the pipe was placed, this cofferdam was used as forms for pouring the concrete seal. A thickness of at least 18 in. of concrete on the top and 30 in. on each side was used to seal the pipe.

A three-legged gantry was used to place the 12-ft lengths. Two legs of this gantry rode on rails spaced 16 ft. apart on a trestle built to one side of the outfall location for construction purposes and the third leg rode on the outer row of the sheetpiling.

Pipe sections were brought to the trestle by one of the two job locomotives which operated on standard-gage tracks on the trestle. The sections were then picked up by the gantry, moved out to a position over the trench and lowered in place.

A 16-ft. long section to afford transition from the 12-ft. lengths to the 100-ft. lengths was used to start construction. This section on the inshore end had a joint which fit the inshore pipe joints. The outshore end was a bell joint like that used on the 100-ft. lengths. After this section was set in final position, work proceeded in both directions, the long lengths being set on the outshore end and the short lengths on the inshore end.

The transition section was cast on falsework supported by the cofferdam just over its final location. Weighing some 130 tons, it was then lowered into place without the use of pontoons or other methods of extra buoyancy.

This project was designed and constructed under the supervision of Lloyd Aldrich, city engineer, Los Angeles, with design under the direct supervision of H. G. Smith, engineer of sewer design, and construction under C. E. G. Wikoff, chief inspector. Contractor on the $3,517,410 project was Guy F. Atkinson Co. for whom D. E. Root is vice-president and chief engineer in charge of the southern California area; John J. Morton was project manager and Philip N. Fletcher project engineer.

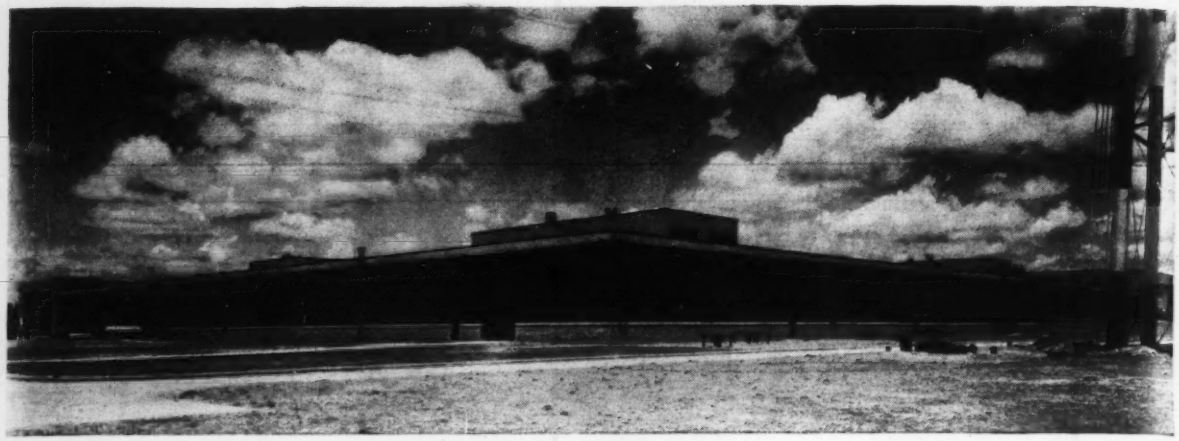


FIG. 1. THE EXTERIOR of an auto assembly plant at Hapeville, Ga., consists of brick, glass windows and gunite walls.

Ford Builds an Auto Plant in Georgia

AN EFFICIENT production layout for a $6,000,000 automobile assembly plant for the Ford Motor Co. at Hapeville, Ga., was obtained through design consideration for the flow of materials in process. Among provisions made to achieve this purpose were wide column spacing and incorporation of a double-track railroad siding in the structure.

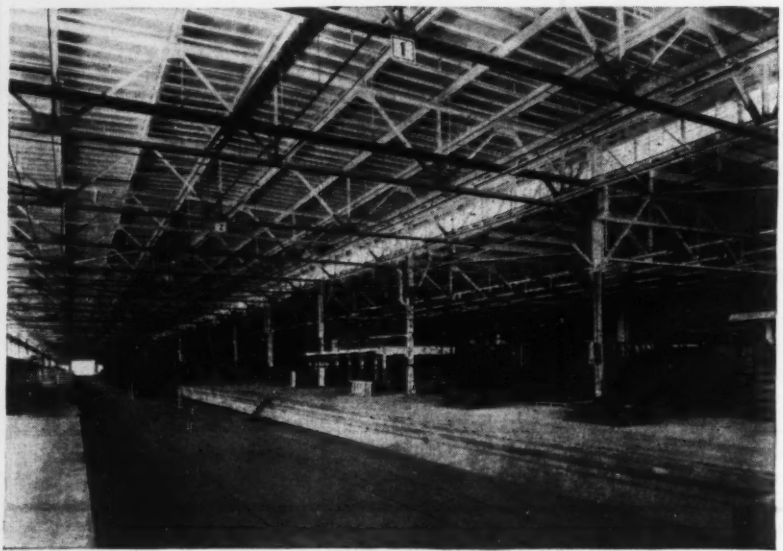
Located near Atlanta, the site is landscaped to create a park-like atmosphere, and buildings were designed architecturally to harmonize with the surrounding residential and industrial sections. Principal structures include a 470 x 1,040-ft. assembly plant, an office building, a garage, an oil house and a boiler house. All are steel-frame, one-story buildings of various heights.

The 319-ft. office building consists of two sections—a high-ceilinged lobby and general offices. The exterior of the lobby portion is of stone, with the entrance marked by four slender piers, and the general offices are faced with buff iron-spot brick. Extensive window areas are provided in the lower part, and glass block in the higher (Fig. 3). A 60 x 225-ft. garage for company cars connects the office and plant.

The assembly building extends south from the garage for a distance of 1,040 ft. It has an exterior facing of buff iron-spot brick to a height of about 4 ft. above the ground, limestone trim, steel sash above, and gunite walls to the eaves (Fig. 1). Supported on structural steel purlins carried on trusses, the roof consists of 2¾-in.-thick precast concrete slabs, 1½ in. of insulation board and four-ply roofing felt and slag. Bays are generally 40 x 50 ft., with working aisles of varying length provided for flexibility in flow of materials. General lighting is fluorescent.

A depressed double-track railway spur enters the building on the north and extends along the west side (Fig. 2). Incoming parts are processed as they move across the floor to their stations on the assembly line on the east. The assembly line terminates at the northeast corner of the plant, where cars are driven outside for a test run on a track provided for that purpose.

Employee facilities are provided in a 120 x 400-ft. mezzanine section,



All photos Albert Kahn Associated Architects & Engineers, Inc.

FIG. 2. THE ASSEMBLY PLANT is of steel-frame construction, with concrete floor and precast concrete roof deck. A double-track railroad siding extends into and along one side of the building.

which extends transversely across the plant about midway of its length (Fig. 3). Entrance to this section from the 450-car parking lot on the east side of the plant is achieved by means of a four-stairway steel bridge, 20 ft. wide by 117 ft. long that carries over service or plant roadways. Steel stairways connect the mezzanine and the assembly floors.

Heating and ventilation

The main factory area is heated by a forced hot-air system supplied from eight large fan rooms located in the roof trusses. The heated air is circulated through an overhead duct system in the truss space and is partly recirculated with about 25 percent fresh-air make-up in the winter. This amount of fresh air is somewhat in excess of the process-air exhaust and creates a slight pressure in the building, which is desirable in the winter. The same units are operated with 100 percent fresh-air supply in the summer, this air being exhausted through roof ventilators (Fig. 3).

The mezzanine is heated by a combination of radiators and a ventilating system, and the office section is heated by a forced hot-water heating system, together with a hot-blast system for ventilating the area. The office section, cafeteria, and first-aid sections are air conditioned in the summer by equipment with a capacity of 275 tons of refrigeration.

Floors cast prior to steel erection

At the time construction started, strikes in the coal, railroad and steel industries delayed steel shipments, and after the strikes were settled, deliveries could not be assured to maintain work schedules. Consequently, it was decided to place the concrete floor slab before erection of the steel.

This decision effected a saving of about two months in construction time. It made possible continuous maintenance of working forces, use of rubber-tired cranes for steel erection (Fig. 4) and employment of rolling scaffolds by the contractors on mechanical work who followed closely behind the steel erection. The possibility of damage to the floor by heavy equipment or weathering was considered a negligible disadvantage.

Steel forms were placed on the center lines of columns for a length of 400 ft. for casting the floor slabs, thus providing construction joints 40 ft. apart. Aggregate and cement were batched dry in a 1-cu. yd. paver supplied by five trucks, and the 26 bays were poured in 26 working days.

Composed of a 1:1.99:3.27 mix, with an average compressive strength of 4,500 psi., and reinforced with 6x6-in. by No. 6 wire mesh, the floor has a uniform thickness of 6 in. In view of the slope of the natural ground surface, the floor was sloped 1.5 in. in 40 ft., thus saving a substantial amount of grading, and also giving a pitch to overhead piping. A metallic hardener was troweled into the floor surface.

The plant was built by Thompson & Street of Charlotte, N. C., with A. L. Fox as project manager. Frank Packard was in charge of construction for Albert Kahn Associated Architects and Engineers, Inc., the designers, and Howard C. Rutledge represented the Ford Motor Co. on the job.

FIG. 3. AIR VIEW shows office section in foreground and the 1,040-ft. long assembly plant to the rear. The mezzanine section houses employee facilities.

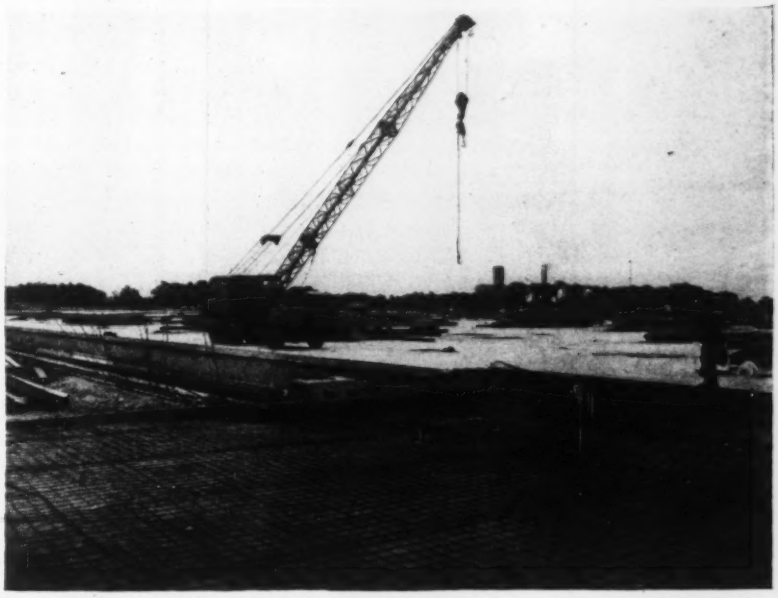
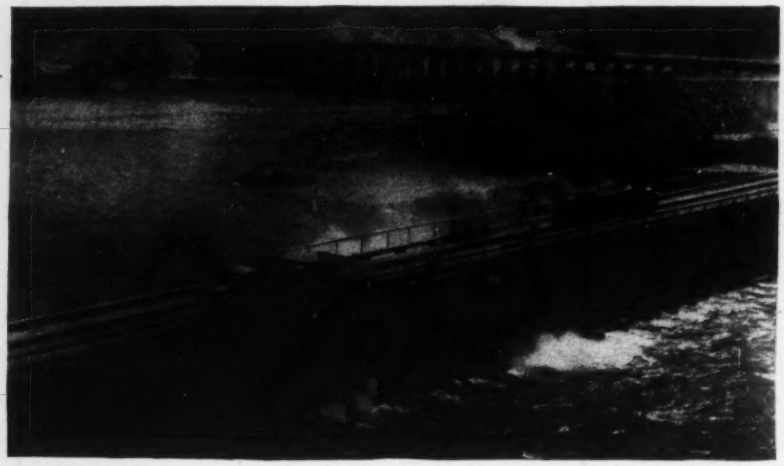
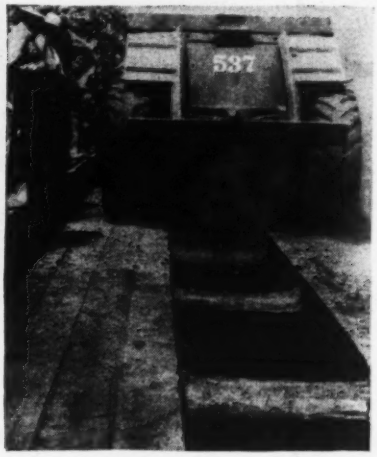


FIG. 4. THE PORTION of the concrete floor that was cast was used by rubber-tired cranes for distributing and erecting steel. In the foreground, wire mesh reinforcement is in place and ready for concrete pouring.

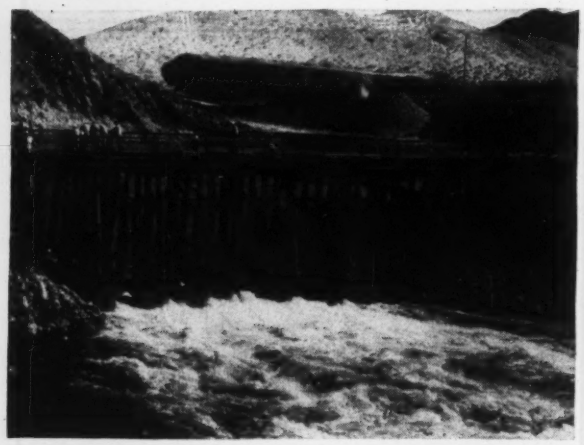
STEP-BY-STEP AS COLORADO RIVER IS DIVERTED TO NEW COURSE



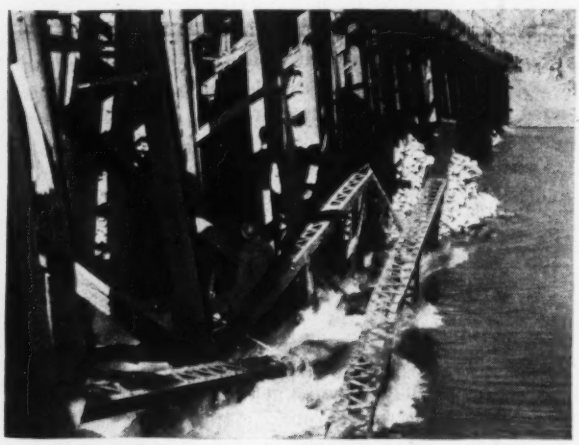
SHUTTLING ACROSS this trestle over the main river, a fleet of bottom-dump trucks, of 13-yd. capacity, dumped rock through . . . . . .



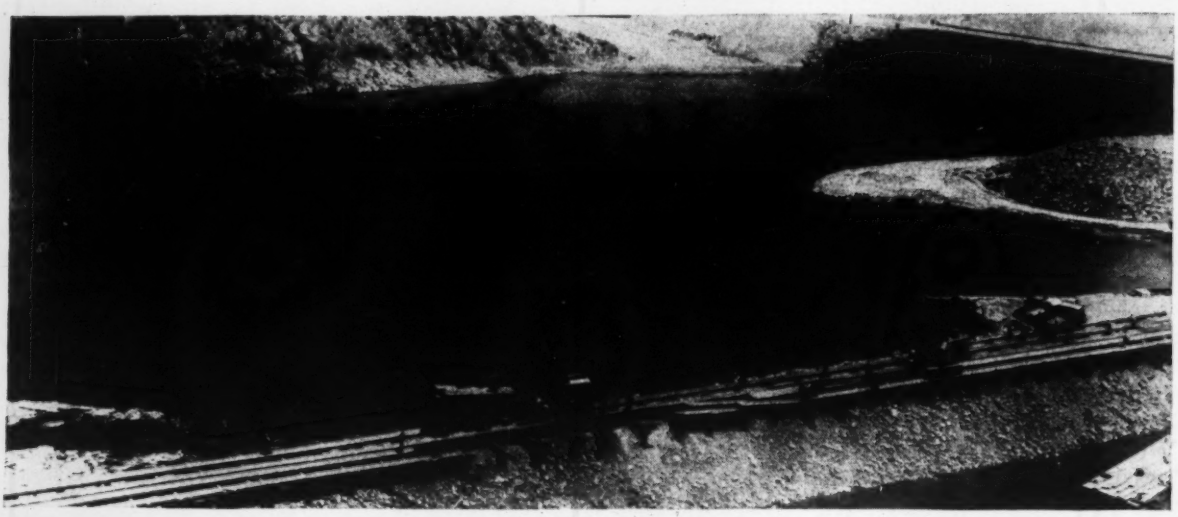
THIS SLOT, 3½ ft. wide, to permit use of rock up to about 3 ft.



AS THE GAP NARROWED, current was so great that no rock could be held in the channel, and contractors set . . . .



SCRAP STEEL framework against the upstream face of the trestle to hold center section of the fill.



THE FINISHED FILL has finally turned the river into its new channel, and workmen begin demolishing the trestle. The entire filling operation was completed in a 56-hr. period.

Rock Fill Diverts River at Davis Dam

WITH THE DIVERSION of the Colorado River June 26-28, the Utah Construction Co., contractor on the Bureau of Reclamation's Davis Dam project, is ready to start work on the dam proper.

Diversion came after two years of work required to build the diversion and forebay channels as well as portions of the trash rack and spillway structures, all of which will be permanent parts of the completed project (*ENR* Aug. 23, 1946, vol. p. 230).

The diversion was accomplished during a 56-hr. period. Most of the rock core of the upstream cofferdam was placed by bottom-dump trucks, shuttling across a slotted timber trestle. Two quarries had been made ready, one on the Arizona and one on the Nevada side of the river. The twenty bottom-dump trucks loaded at one quarry, dumped while crossing the river, then loaded and dumped again on the return trip.

Operations started early on the morning of June 26. By nightfall, rock began to show above the surface of the river, where the flow varied from 12,000 to 18,000 sec.-ft. during the diversion.

It was hoped that by dumping uniformly across the trestle, the river would be gradually diverted at right angles into the diversion channel, and by nightfall of the second day the cofferdam was effective, except for a 40-ft. channel near the center. But here the current became so strong that even the largest available rocks were swept away. During all of the second night, dumping continued in this portion with the hope that some headway could be made. These efforts were fruitless.

The contractor then adopted emergency measures. Frameworks of scrap steel were placed in the gap on the upstream side of the trestle. A ramp was built out at about river level to the gap. End-dump trucks then backed out the ramp one at a time and dumped large rock against the scrap steel. This slowed the current and bottom-dump trucks working on the trestle, together with the end-dump trucks working on the ramp, finally closed the channel after a 56-hr. struggle.

Third Colorado diversion

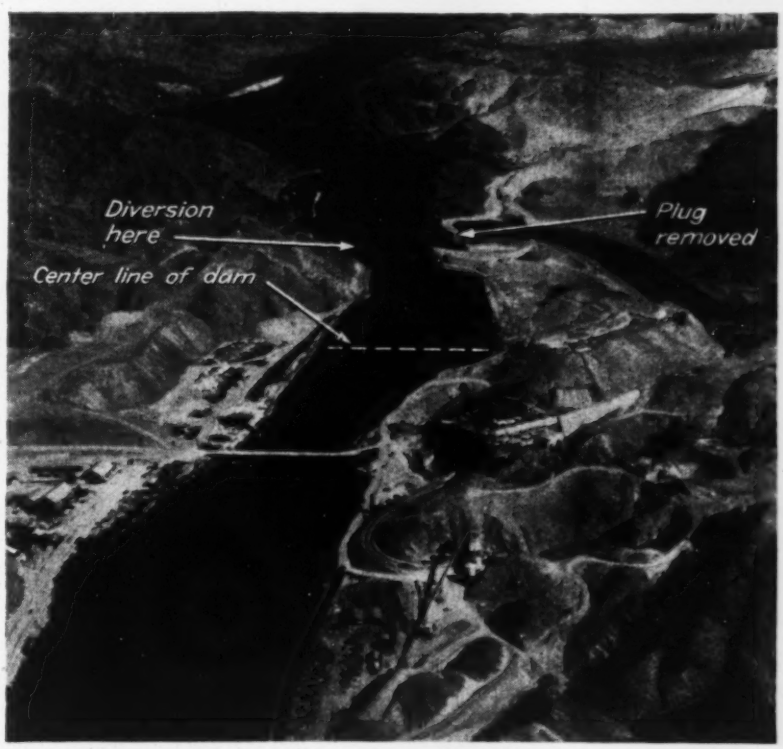
This is the third time that the Colorado River has been diverted from its channel. At Hoover Dam and again at Parker Dam the river was diverted through temporary diversion tunnels, but the Davis diversion is the first on the Colorado through a river-size channel around the end of the dam location.

The Hoover Dam diversion (*ENR* Nov. 7, 1932, vol. p. 622 and Dec. 15, 1932, vol. p. 708) was accomplished by blasting temporary cofferdams from in front of the tunnels and then building a dike across the river, using end-dump trucks. Only 6,000 sec.-ft. was flowing at the time and the entire diversion took less than 15 hours. A similar scheme was used at Parker Dam (*ENR* 1937-II, vol. p. 853).

Some 29,000 cu. yd. of rock was placed in the 56-hr. period and it is estimated that about one-third of this was washed downstream. Final stages of the diversion were scheduled on Sunday and Monday to take advantage of low flow in the river due to decreased week-end power generation at Hoover Dam.

The trestle used for the work is now being removed and the cofferdam will be covered with impervious material to help prevent seepage into the damsite. Center line of the cofferdam is some 800 ft. upstream from the center line of the earth-and-rock fill dam, and since fill for the dam will be placed on 8 to 1 and 3 to 1 slopes, it will extend from the cofferdam to the top of the dam.

Since the time work started on the present contract, early in 1946, the contractor has constructed the diversion and forebay channel—a canal



NEW COURSE FOR THE RIVER—An aerial view shows the site of Davis Dam, and the point of diversion. Concrete plant and trestle for pouring concrete is on right, and contractor shops and yards are on the left, or Nevada, side of the river.

two-thirds of a mile long around the left abutment of the dam. Minimum width is 75 ft. and the depth is about 150 ft. Some of the cuts are more than 200 ft.

At the downstream end of this channel, the spillway and the powerhouse trash racks have been built up to above El. 550. This will permit a 50-ft. depth in the channel during the diversion period. The river will flow through openings left in the spillway structure. As the dam takes shape, the spillway can be built to its eventual crest, El. 597. Three 50x50-ft. radial gates to be mounted on top of the spillway will eventually bring normal high water to El. 647.

Excavation for the dam foundations will go some 50 ft. below normal river-bottom level. A system of well points completely encircling the excavation will be used. It is estimated that some 150 mg. will have to be removed from the excavation. Most of this will be accomplished by four 3,000-gpm. capacity pumps. Subcontractor for dewatering of the dam foundations is the John W. Stang Corp. of New York.

Davis Dam is a project of the U.S. Bureau of Reclamation, for which H. F. Bahmeier is construction engineer. Construction work is under the direction of the Utah Construction Co., for which H. E. Williams is project manager and T. L. Terry is general superintendent.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York

Extra or Additional Work

"Extra work" as used in connection with a construction contract, means work of a character not originally contemplated by the parties and not controlled by the original contract. It is distinguished from "additional work", which may fairly be presumed to arise in the proper construction of an improvement, although not included in the original plans and specifications or specifically mentioned or referred to in the contract. (17 Corpus Juris, p. 851)

The distinction between "extra" and "additional" work is often not easy to draw. Additional work is usually work that results from a change or alteration of the plans and concerns work that was to be done under the contract. Extra work relates to work which is not included in the contract itself. (DeMartini v. Elade Realty Corp., 52 N. Y. S. (2nd) 487).

Right to Recover Increased Cost Resulting from Misrepresentations

Where there is a definite misrepresentation in the plans and specifications, the contractor generally is entitled to recover the increased cost of the work resulting therefrom[1]. The same rule applies where information furnished the contractor does not form part of the contract but is given without guarantee as to its accuracy. But it must be shown that the other party had knowledge or could be charged with knowledge of the falsity of the information furnished[2].

It is no excuse for a culpable misrepresentation that means of probing it were available to the contractor[3]. A person deceived by the fraudulent misrepresentation of another owes him no duty of active vigilance to discover that the representations made were false[4].

The general rule is that where plans and specifications indicate certain conditions exist and may be relied upon in preparing a bid, the contractor is entitled to compensation for increased cost of the work resulting from different conditions encountered [5].

A provision that the contractor will not claim increased cost for work that may result from misrepresentations will not be enforced. A party to contract cannot by misrepresentation induce another party to enter into a contract to his damage, and then protect himself by such a clause[6].

The fact that the contract provided that the contractor should investigate the site of the work does not bar the right to recover where the party had knowledge of the fact that conditions were not as represented. The contractor had a right to rely upon information set forth on the contract drawings[7]. But, representations may be such as to indicate clearly the intention of the parties that the contractor should rely upon his own investigation. In such case he cannot recover upon the misrepresentations[8].

After performance of the work and receipt of full payment, if it is discovered that the owner had knowledge of misrepresentations in the plans and specifications, the damaged party can rescind the contract and sue for the fair and reasonable value of the work [9].

(1) Christie v. United States, 237 U.S. 234.
(2) Jackson v. State of New York, 210 App. Div. 115, affd. 241 N.Y. 563.
(3) Albert V. Title Guarantee & Trust Co., 277 N.Y., 421.
(4) Mead v. Bunn, 32 N.Y. 275.
(5) Maryland Casualty Co. v. City of Seattle, 116 P.(2d) 280.
(6) Jackson v. State of New York, 210 App. Div. 115, affd. 241 N.Y. 563.
(7) L. I. Waldman & Co., Inc. v. State, 41 N.Y.S. (2d) 704.
(8) Leary v. City of Watervliet, 222 N.Y. 337, 118 N.E. 849.
(9) Frank Nordone Contracting Co., Inc. v. City of New York, 59 N.Y.S. (2d) 256, 269 App.Div. 1035.

Reference To Plans And Specifications

Where a building contract refers to the plans and specifications and so makes them a part of the contract itself, the general rule is that they are to be considered together with the contract in construing it. The specifications are but the particulars or details of the plan and the term "plan" fairly embraces the specifications of the buildings.

Where the plans and specifications are by express terms made a part of the contract, the terms of the plans and specifications will control with the same force as though incorporated in the very contract itself. Where, however, the plans and specifications are referred to in the contract for a particular purpose, such specifications can serve no other purpose than the one specified and are foreign to the contract for all other purposes.

In the absence of express provisions in the contract, the specifications can neither restrict nor extend the scope of the contract to subjects other than those covered by the contract. (Pittsburgh Plate Glass Co. v. American Surety Co. of New York, 19 SE (2d) 357.)

ROAD BUILDING IN THE CUMBERLAND MOUNTAINS of Tennessee involves big cuts and fills, mostly in solid rock.

Moving Mountains to Make a Highway

RUGGED TERRAIN, heavy rock excavation and precipitous drainage-draws to be "boxed", presented a challenge of incredible magnitude to engineers and contractors alike on the three-lane federal-aid highway relocation project now under construction in southern Tennessee. But somehow, the location survey was made, cross-sectioning completed and veritable mountains of rock are being moved by a combination of heavy blasting, power shovel, bulldozer and tractor-drawn rock carts.

Located near Monteagle, Tenn., on U. S. Highway 41 on the western slope of the Cumberland Mountains, the completed 4.1-mi. project will constitute a long-needed high-speed link in the heavily traveled main highway between Nashville and Chattanooga. Work was started last Nov. 15 and the grading and drainage structures are scheduled for completion this Oct. 1.

Construction procedures, some of which may seem unorthodox at first glance, are the result of long experience in this mountainous country—and they are paying dividends in both speed and economy of operation.

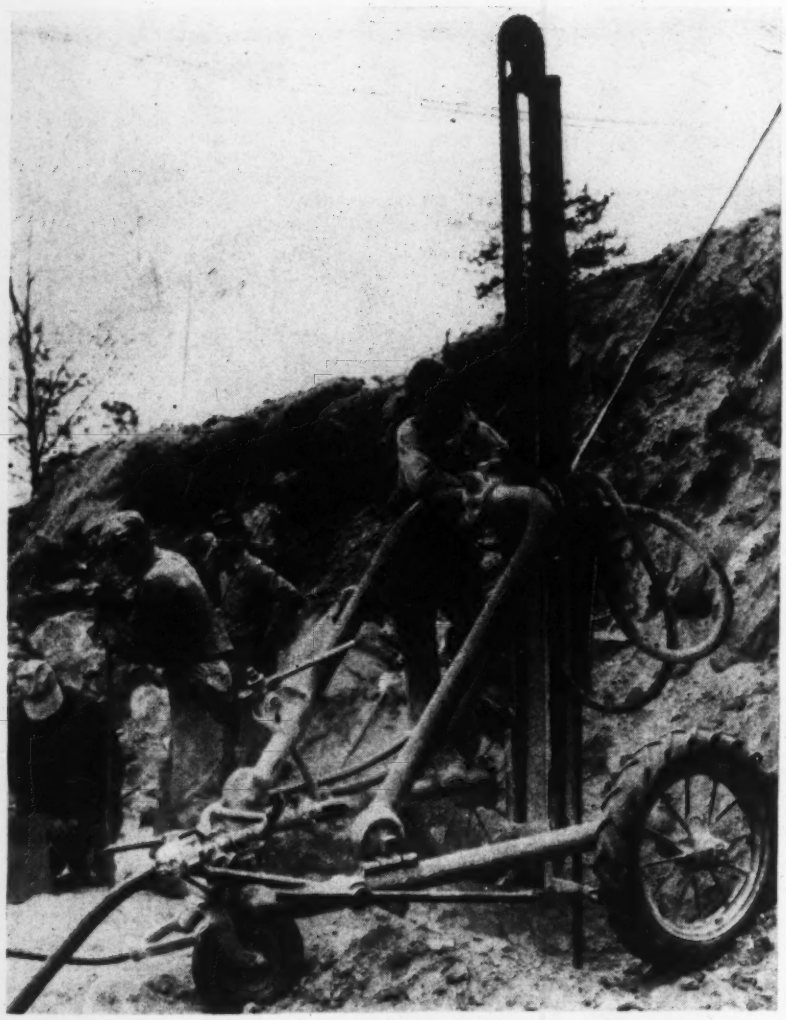
"Zero" length of haul

For example, the ground profile along the centerline of the roadway breaks so sharply between rock cuts and fills that the contractor has practically a "zero" length of haul for a large portion of his excavation —90 percent of which is solid rock.

After a cut has been blasted 18 to 24 ft. deep, a 1¾-yd. power shovel moves in on either face, excavates rock in front, swings 180 deg. and deposits it behind. From this point a bulldozer pushes the rock over the edge of the cut, to form the base of the adjacent embankment.

As the excavation progresses away from the open end of the cut, a fleet of special tractor-drawn rock carts are added to carry the excavated rock a short distance from the shovel to the edge of the cut where the bulldozer pushes it over the edge. These rock carts are cable-operated, end-dump, with a 12-cu.yd. capacity (struck measure), mounting two 18:00x24 pneumatic rubber tires in front and four at the rear.

Even for longer hauls, the tractor-drawn rock carts are used to good advantage, since the dearth of earth in the rock cuts prevents the establishment of haul roads smooth enough for high-speed earthmoving scrapers. One 16-yd. earth-moving scraper with bulldozer is used for stripping over-



LOADING WITH 60-PERCENT DYNAMITE, 10-lb. per 24-ft. hole, follows close behind the three wagon drills used in heavy rock cuts.

STURDY TRACTOR-DRAWN CARTS are called for because of short hauls, rugged terrain and 90-percent rock excavation.

burden and on long hauls involving earth.

Yardages contained in some of the fills are almost incredible. The biggest fill is 165 ft. high, containing 155,000 cu. yd.—most of which is rock. Another is 149 ft. high, containing 73,000 cu. yd. of rock. And, in the entire 4.1 mi. of new highway there will be a total of 643,000 cu.yd. of rock excavation.

Blasting the rock ahead of the excavation is a tremendous job. The contractor uses three wagon drills—one powered by a 315-cfm. compressor and the other two by a 500-cfm. compressor.

Holes are drilled 18 to 24 ft. deep, spaced about 5 ft. each way. The first 6 ft. of hole is drilled with a 2-in. bit, with diameter of bit decreasing $\frac{1}{8}$-in. for each 6 ft. of additional hole. Each hole is loaded with about twenty $\frac{1}{2}$-lb. sticks of dynamite and fired in series of from 50 to 400 holes at a time. Both 40- and 60-percent dynamite are used, with non-delaying fuses. Production of rock, which is a fairly hard sandstone, runs fully 1 cu.yd. per pound of dynamite.

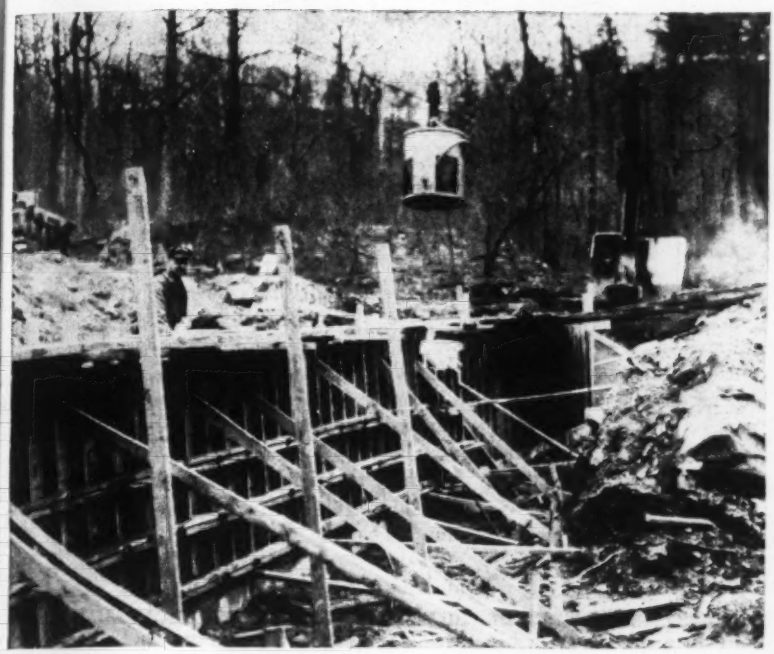
Cableways from shovels

Construction of the 19 reinforced concrete box culverts on the 4.1-mi. project posed special problems in placing concrete, due to the unusual length and the steepness of flow-line gradient. Longest box culvert is 8x6x280 ft., on a 37-percent grade.

Placing concrete in these box culverts by ordinary wheelbarrow or concrete-buggy methods was out of the question, due to steep slopes. To solve this problem, the contractor rigged an improvised cableway over each culvert.

A $\frac{3}{8}$-yd. power shovel was spotted opposite the upper end of the culvert, on a leveled area beside a temporary haul road. The boom was elevated and anchored to a tree directly aft. Hoisting cable was run from the end of the boom, directly over the center line of culvert and anchored below the outlet end. This formed the cableway. An 8-in. sheave carrying a three-bag bottom dump concrete bucket was mounted on the cableway, with its movement being controlled by the "crowd" cable of the shovel.

To pour concrete into the forms,



CONCRETE FOR LARGE BOX CULVERTS on steep slopes was placed by cableway, anchored and operated by a ⅜-yd. shovel positioned above culvert invert. The shovel boom was tied back to a tree.

the bucket was first retracted to the upper end of the cableway. The shovel moved back slightly, slacking off the cableway and permitting the bucket to rest on the haul road. Concrete from a three-bag mixer was discharged directly into the bucket. Slack was taken out of the cableway by running the shovel forward a little, lifting the concrete bucket clear of the ground. Then, by gravity, the bucket was run down over the box and lowered into position for dumping by slacking off on the cableway.

Design plans call for a 42-ft. crown width of embankment in cuts and a 58-ft. crown on fills, to carry two 11-ft. concrete lanes for high-speed traffic and a 12-ft. concrete lane on ascending grades for trucks. This truck lane will have a pink-colored concrete surface, indicating it is for slow-speed traffic. Embankments also will carry 12-ft. shoulders, while cuts will be protected by 4-ft. concrete gutters. Roadway pavement will be reinforced concrete, 10 in. thick.

Total contract price for the 4.1 mi. of grading, including the 19 reinforced concrete box culverts, is $680,000. Unit contract price for the "unclassified" excavation, which includes the 90-percent rock and 10-percent earth is $0.69 per cu. yd.

Contractors and engineers

H. E. Wolf Construction Co., St. Augustine, Fla., is the contractor. L. V. Wesley is superintendent of construction and Homer Chasteen assistant construction superintendent. E. L. Sandy is resident engineer for the Tennessee Department of Highways; T. M. Burnett, division construction engineer; S. M. Squires, division engineer; and O. F. Goetz, state construction engineer. All work is under the supervision and direction of W. T. Brooks, state highway engineer and C. W. Phillips, commissioner.

Report on Vibration Generators Now Available

The construction and operation of a vibration generator capable of exerting forces up to 44,000 lb. and used by the U. S. Navy Department to investigate the dynamic characteristics of ships, bridges, and similar large structures is described in a report now on sale by the Office of Technical Services, Department of Commerce.

The report was prepared by E. O. Berdahl of the David Taylor Model Basin of the U. S. Navy Department, Washington, D. C. The Navy acquired the generator from the Losenhausen Works in Dusseldorf, Germany in 1931.

The generator, described in the report as "capable of producing large vertical sinusoidal forces at low frequencies," weighs 49,000 lb. It has an accompanying control apparatus weighing an additional 500 pounds. The equipment has suitable lugs for handling with a crane. The vibrator develops a vertical sinusoidal force with a maximum single amplitude of 44,000 lb. at speeds from 105 to 480 rpm. It will generate a comparable maximum force of 11,700 lb. in the same direction at its lowest running speed of 54 rpm. Operated on d. c. power, the total rated power consumption of the two driving motors is 30 kw., according to the report that is now available.

The report (PB-81751 Construction and Operation of the Losenhausen 14,000-lb. vibration generator) 31 pp. 1947, sells for $4 per photostat copy, and $1.75 per microfilm copy.

Another report on a small portable vibration generator used at the David W. Taylor Model Basin was previously released by OTS (PB-57508, *Construction and operation of the Losenhausen 440-pound vibration generator*, 23 pages, photostat, $2, microfilm, $1.)

Small light-weight generator

The smaller generator produces a force of 440 lb. and weighs 140 lb. It operates on a principle similar to the larger 44,000-lb. generator.

Orders for the reports should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order payable to the Treasurer of the United States.

Steel-Drum Crib For Cleveland Intake

A. A. Burger
Havens and Emerson, Consulting Engineers
Cleveland, Ohio

IN DEVELOPING the design of the $6,000,000 Nottingham Intake, now under construction in Cleveland, Ohio, primary consideration was given to economy, safety and speed of construction by a thorough analysis of the manner in which it is to be built. In fact, the entire design was colored to unusual degree by considerations of construction.

Principal features of the project include: (1) A submerged crib to be located in about 50 ft. of water 3½ mi. offshore; (2) a 10-ft. dia. concrete pipe intake to be installed in a dredged trench along the bottom of Lake Erie, between crib and a shore shaft; and (3) a 1½-mi. land section of the intake, to be built as a 10-ft. dia. free-air tunnel connecting the shore shaft with an existing screen well at the site of a proposed water treatment plant.

The capacity of these works was established in terms of the future at 150 mgd., with initial purification facilities designed for 100 mgd. A detailed study of the hydraulics of the line, however, disclosed that at relatively small additional expense the shore end of the intake could be lowered a few feet, increasing the normal intake capacity to 200 mgd.

This added capacity was incorporated in the design. Its significance is that the required intake capacity will be maintained during extreme lowering of the lake level caused by offshore wind or other circumstances.

Heavy timbers normally used in the construction of submerged cribs were not readily available, so planning turned to a steel structure. As designed, the crib is something like a huge drum with parts of the two heads omitted. It will be 76 ft. in dia., 12 ft. deep, and fabricated of ¾-in. steel plate well reinforced with angles and other structural shapes. Steel surfaces exposed to flowing water will be coated with reinforced, gunited mortar ¾ in. thick. Other surfaces will be coated with bitumen.

The bottom head of this drum is to be completely floored with steel plate except for an 18-ft. dia. center hole into which will be welded a vertical collar extending 6 ft. up into the drum. This opening will contain the upturned elbow of the intake pipe. The interior of the drum or crib is broken up into a series of three concentric compartments by a system of radial arms and octagonal frames.

The innermost compartment is essentially a structural element, being a 6-ft. dia. compression ring, 4 ft. deep, formed of 1-in. plate and attached to the upper deck or head of the drum. From this compression ring radiate the eight radial members which extend like the spokes of a wheel to the periphery of the crib.

The second row of concentric compartments takes up the greater part of the structure, being about 28 ft. wide and extending the full circumference of the crib, unbroken except by an interior baffle. This part of the crib will be decked with steel plate for about half its width—the balance of the area consisting of wood screens made up of 3x12-in. timbers to provide 3-in. clear openings.

The third and outermost ring of the crib, which is about 7 ft. wide, is divided into 16 compartments. Every alternate compartment of this ring is made water-tight with top, bottom and side plates. The remaining eight units are open at the top.

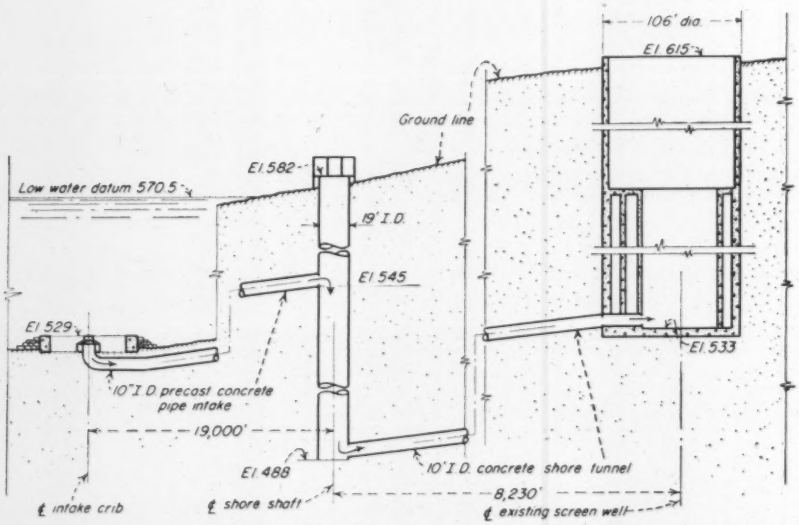


FIG. 1. NOTTINGHAM INTAKE will have a submerged steel-drum crib (left), a 94-ft. shore shaft, and 5 mi. of 10-ft. dia. intake and shore tunnel.

Floated by water-tight compartments

The water-tight compartments are for floating the crib which, unloaded, will weigh about 360 tons. Fabrication will be inshore, probably on launching ways. Preparation for seating the crib at the point of final location calls for excavating a 90-ft. dia. pit 5 ft. below lake bottom and backfilling 3½ ft. with 1½- to 4-in. stone. The crib will be towed to place, centered above the previously placed intake elbow, and lowered onto the stone cushion by opening valves to the floatation compartments.

After the crib has been positioned, the covers of the eight water-tight compartments will be burned off, and

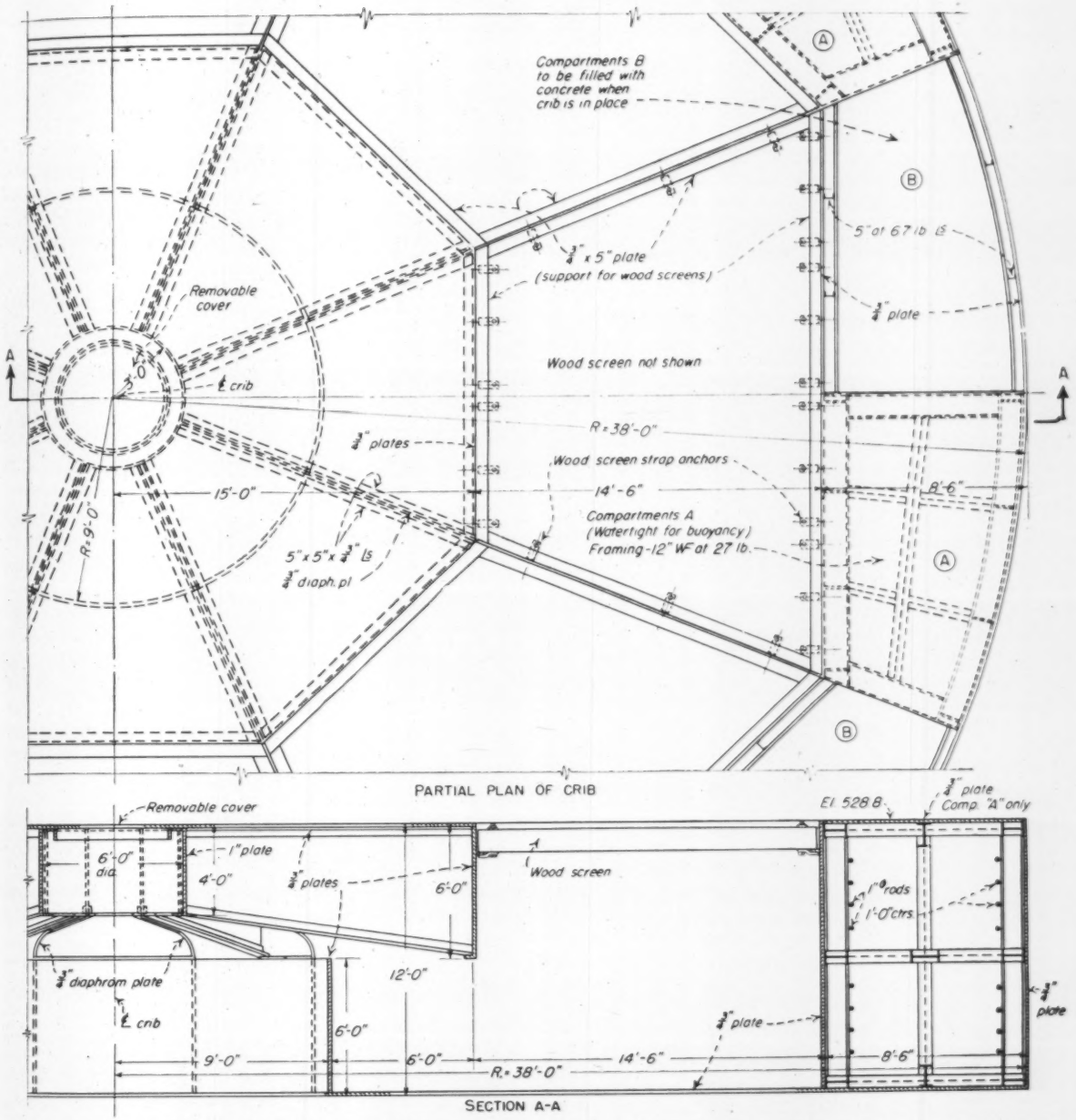


FIG 2. ALL-WELDED 76-FT. DIA. STEEL-DRUM INTAKE, with watertight compartments for buoyancy, will weigh 360 tons unloaded, and 1,100 tons when sunk in final position and ballasted with concrete.

all 16 outer compartments filled with concrete which will be placed by tremie, drop bucket, by pumping or in some other suitable manner. Thus loaded, the net effective weight of the structure will be about 1,100 tons.

After the crib is seated and loaded, the remainder of the excavation will be filled with crushed stone and 5-ton stone blocks placed in three layers about the crib, the bottom layer extending about 16 ft. from the crib.

When completed, the 76-ft. dia. crib, surrounded by 16 ft. of large stone will stand with its top some 10 ft. above lake bottom. Water will enter through screens in the top deck, under one baffle and over another into the upturned leg of the intake pipe. The baffles, incidentally, are designed to entrap sand, although the possibility of an appreciable amount of sand entering the crib is problematical. If it does, it necessarily will be removed by divers and marine maintenance equipment.

The clear or open area of the intake screen is more than ten times that of the intake itself. Intervening waterways under and over baffles are proportioned so that there will be progressive increase in velocity of the water from a minimum of 3 in. per sec. at the screens to 3 ft. per sec. in the pipe at design capacity.

Experience has showed that in deep water with a minimum velocity of 3 in. per sec. through the screens there will be no risk of anchor or

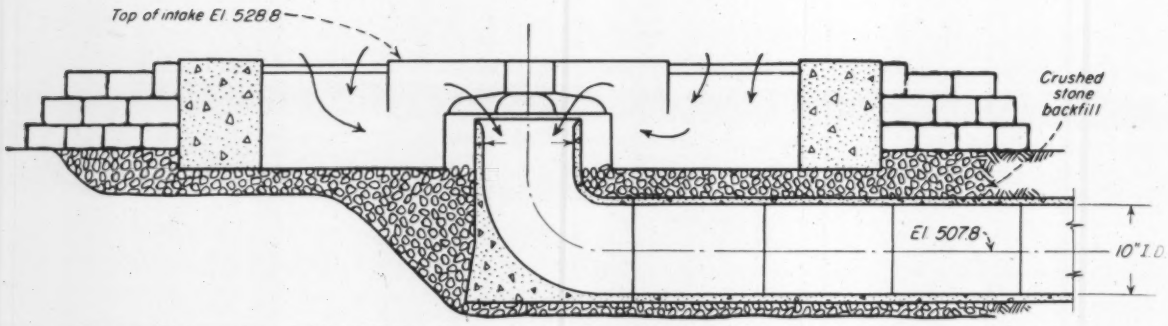


FIG. 3. WATER ENTERING INTAKE SCREEN at 3 in. per sec. will flow over and under baffles, increasing in velocity to 3 ft. per sec. in the intake pipe at designed operating capacity.

frazil ice sealing off the intake. Moreover, wood chosen for the screens, due to its low heat conductivity, further safeguards against anchor ice.

The intake itself will consist of a 10-ft. inside dia. pipe which, for the 3½-mi. lake section, will be precast concrete pipe laid in open trench of sufficient depth to provide a 4-ft. minimum cover, but conforming as well to an hydraulic grade line.

As has been indicated, the selection of open-cut construction was based on considerations of safety, economy and speed.

Both of Cleveland's existing intakes in Lake Erie—serving the Division Avenue and Baldwin plants—were built in tunnel, which was normal construction for the earlier lake intakes of appreciable size.

Within recent years, however, marine-dredging equipment has been developed for work at considerable depths, and conferences with marine contractors established the fact that suitable equipment for dredging to a 65-ft. depth could be brought to Cleveland. Further investigation showed, also, the feasibility of laying and jointing a 10-ft. intake of steel or concrete under water.

One advantage of tunneling is that it permits year-around construction, whereas work from the surface is subject to interruption by storms or by ice. Borings along the lake bottom, however, showed that any tunnel would have to be located at considerable depth unless it were built under compressed air. Moreover, the shale which underlies the lake bottom contains pockets of gas which in previous operations has proved hazardous.

Considerations of this nature, supplemented by examination of boring cores, and by studies of comparative costs, finally led to the decision of building the lake section in open cut.

FIG. 4. ALL TUNNELING for the shore section of intake is expected to be free-air work, in hard gray shale. First heading for the 12-ft. nominal diameter bore was started from existing screen well, with provisions made for starting two additional headings from an intermediate work shaft.

The pipe is to be laid on a grade which rises from crib to shore shaft so as to avoid air pockets. Previous soundings serve to establish the general profile, but it is required that new soundings be taken at 100-ft. intervals in advance of pipe laying, and the final profile will be determined from these soundings as the work progresses.

For laying the pipe, the trench will be dredged to the required subgrade and a sand cushion placed and leveled off to receive the pipe. After the pipe is laid and jointed, the trench will be sand filled to a plane 1 ft. below the center line of the pipe. Following testing of the line, the remainder of the trench will be backfilled up to the original lake bottom.

Both steel pipe and concrete pipe were included in the proposals for the lake section of intake, but no bids were received on the former. Consequently, the pipe will be precast concrete. It will be cast in 24-ft. lengths, weighing about 50 tons each.

The concrete pipe will conform to ASTM specifications for culvert pipe made with 4,500-psi concrete. Wall thicknesses will be 10 in. with three lines of reinforcement. Joints will be tapered slip joints in which contact surfaces will be made of steel rings embedded in and anchored to the walls of the pipe sections.

Joints of pipe will be tied together by a pair of 2-in. bolts, located at the springing line of the pipe and engaging matching lugs anchored to the pipe. Tightness of joint will be assured by a rubber gasket placed between faces of the slip joint.

Specifications for this part of the work provide that each 500-ft section shall be tested under internal hydrostatic pressure. Test pressure is set at 10 psi. above that due to the lake

level which obtains when the test is made, with permissible leakage during a 30-min. test period limited to ¼ gal. per lin. ft. of pipe.

Free-air land tunnel

The 8,500-ft. land section of the intake will be excavated as a free-air tunnel, 12 ft. nominal bore, connecting the shore shaft at the end of the lake section with the existing screen well on a rising grade of 0.5 percent. Elevation of the tunnel at the shore shaft will be 53 ft. lower than that of the lake section and about 42.5 ft. lower than the screen well. These elevations were determined from the consideration of providing the tunnel with a roof which included at least 10 ft. of good hard shale.

Tunnel methods are left to the contractor but the specifications impose a number of safety requirements. For example, a safety engineer must be on the job and additional to other duties is to be equipped to detect the presence of such dangerous gases as methane, heptane and carbon monoxide, for which maximum permissible concentrations are fixed. It also is required that four 2½-in. pilot holes be drilled through the heading and be kept extended at least 15 ft. ahead of the rock face at all times, to tap and bleed off gas pockets.

There also are stringent regulations concerning power wiring and lighting, flood lights or storage battery cap lights being permitted not closer than 150 ft. to the face of the heading. Ventilation is required in blower and duct capacity of 10,000 cfm. for each heading.

Provision is made for the use of supporting steel ribs and lagging if such are found necessary. Tunnel lining will be 12 in. of plain concrete placed behind collapsible steel forms built in 25-ft. sections which will be moved on rails set into the invert of the tunnel. To facilitate the placing of concrete and its inspection, 18x24-in. doorways are provided at 5 ft. intervals along the crown of the steel forms and every 10 ft. along the sides.

The permanent shore shaft at the junction of lake and land sections will be located 25 ft. back from the shore line. It will have a working diameter of 19 ft., and 18-in. concrete lining, with 30-in. floor, and will extend 88 ft. below the ground surface. Water from the lake intake will flow

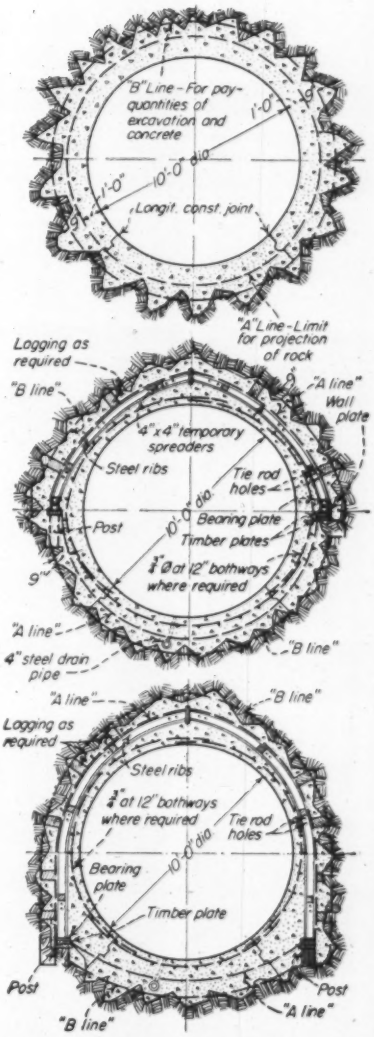


FIG. 5. IN ADDITION TO THE TYPICAL TUNNEL section (at top) acceptable types of roof support include lagged-arch on bench (at center) and on post supports (at bottom).

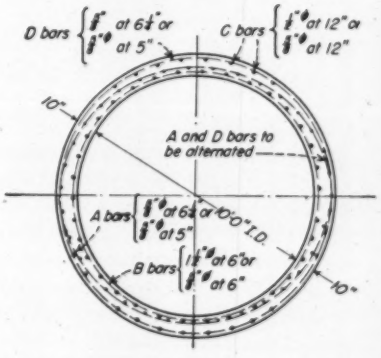


FIG. 6. TWO STRENGTHS OF PRECAST CONCRETE PIPE for the 3½ mi. of submerged intake were secured by varying the size and spacing of reinforcing bars.

downward 53 ft. in the shaft before entering the land tunnel. This shaft, surmounted by a small building, will contain two 72x84-in. sluice gates to permit shutting off the lake intake.

More important, however, the shaft will serve as a surge chamber. Thus, if pumps are shut down or lose power, the momentum of the moving column of water can be dissipated by a spill over eight weirs placed around the periphery of the shaft above high lake level. The spill from these weirs will be carried by conduit to the lake.

Major contract items for the lake section of intake include 18,500 ft. of 10-ft. dia. precast concrete pipe, 440 cu. yd. of concrete, 240 tons of steel sheetpiling for deep-trench excavation near the shore, and 70,000 tons of breakwater stone to provide refuge and loading facilities for marine equipment as well as to protect the shore shaft and surge chamber.

Contract items on the shore section of intake, including the shore shaft, include 45,000 cu. yd. of tunnel excavation, 20,600 cu. yd. of concrete, and 52,000 lb. of tunnel liner plates.

Merritt-Chapman & Scott Corp., New York City, hold a $4,262,000 contract for the lake section of intake, including the crib, to be completed by Dec. 1, 1949. S. H. Serre, resident vice-president is in charge.

The Kalill Co., Cleveland, holds a $1,845,000 contract for the land section of intake including the shore shaft. This contract, scheduled for completion by April 1, 1949, is being supervised by Joe Kalill, owner, and Henry B. Sherman, engineer.

Construction of the Nottingham intake is part of an overall program of water supply expansion and improvement, first proposed in 1920 by an engineering board comprised of the late Robert Hoffman, James W. Frazier and the late James H. Herron, is being put into effect by the Cleveland Utilities Department, under Emil Crown, director, Geo. W. Hamlin, acting commissioner of water, and Frank J. Schwemler, engineer.

Havens and Emerson, consulting engineers, who have prepared the plans and specifications, and will supervise construction, are represented on the job by the author, and by Leet Deibel, resident engineer. Ole Singstad, consulting engineer, New York City, was consulted on some phases of the tunnel design.

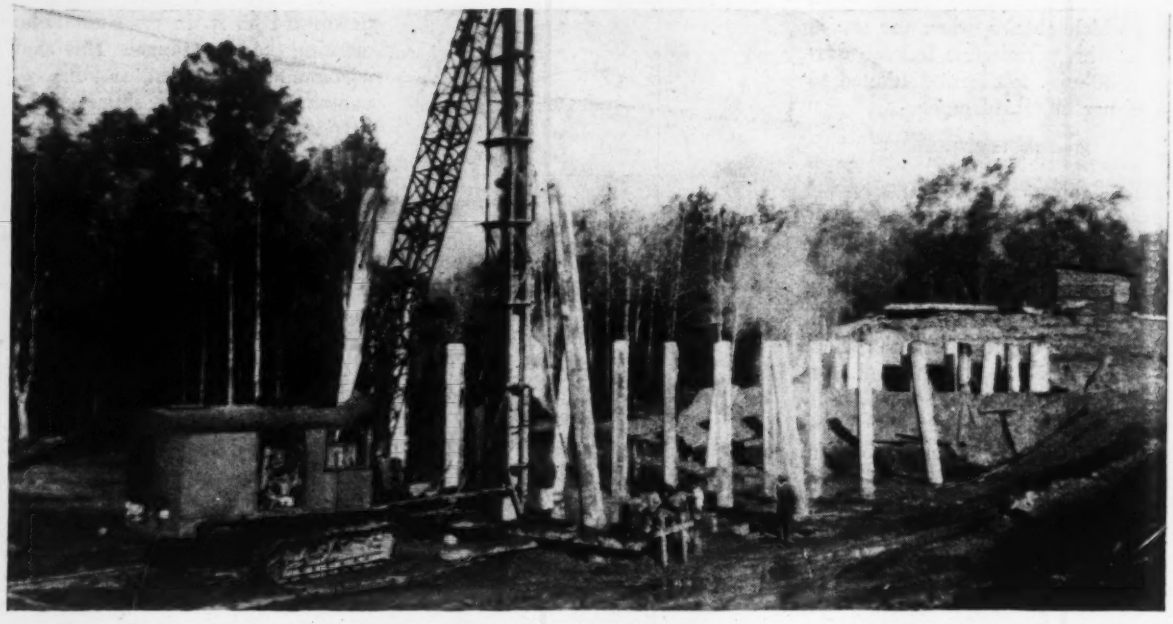


FIG. 1. ALL THE PILES WERE DRIVEN with leads handled by a crawler crane, an adjustable telescoping strut being used between the crane and the bottom of the leads.

Bridge Piles Driven by Precision Methods

TO MANUUFACTURE and drive 21,000 lin. ft. of precast piling for the 2,756-ft. slab-and-girder portion of a new Georgia highway bridge across the Altamaha River on U. S. Route 1, methods offering a high efficiency on all operations were employed. The procedure followed proved so satisfactory that 425 piles were driven without a single one being broken, none needing to be pulled because of poor alignment, and not a single pile needing to be lengthened by adding a section after driving started.

U. S. Route 1 crosses the Altamaha about 14 miles north of the town of Baxley, Ga. Over the main channel a four-span continuous plate-girder unit with spans varying from 91 to 120 ft. is being built. The remainder of the 4,086-ft. crossing consists of eleven steel beam spans and 83 reinforced concrete slab-and-beams spans. It was for the latter spans, which are all simple spans 32 ft. long, that the precast piles were used.

The bridge will provide a 28-ft. roadway designed for an H20 loading and two 2-ft. wide safety walks. To support the roadway of the 32-ft. spans 5-pile bents consisting of two batter and three vertical piles all of 18-in. octagonal cross section were specified. An exception to this arrangement is the last bent at the north end, which required 15 piles. Length of the piles varied from 43 to 62 ft.

At the location where the precast piles were driven, the typical foundation consists of 8 to 10 ft. of muck overlying a coarse sand of a high frictional bearing power. Specifications required that the piles be driven to a 35-ton bearing and 15-ft. minimum penetration; the average bearing obtained was calculated by formula to be nearly 70 tons and the average penetration was 30 ft.

In view of their large number and combined length, the methods to be followed in casting and driving the piles received careful consideration. It was decided to cast the piles at the north end of the project, which avoided the hauling of long loads on heavily travelled highways.

Reinforcing for the typical pile consisted of eight 1-in. round deformed bars—only four bars extending to the point of the pile—and No. 6 wire spiral reinforcing. The spacing of the latter varied from 3 in. at the tip to 6 in. for the main body of the pile.

Special supports speed work

To speed up assembly of the reinforcing cages for the piles, special supports holding the longitudinal reinforcing at the proper spacing were built (Fig. 2). For the longer piles five of these supports, which had a base made of an old truck wheel, were utilized. Use of the supports permitted rapid assembly of a cage and once a cage was finished it could be quickly removed from the supports by pulling out two pins at each support.

Steel forms were used for all piles, and a sufficient number were available to permit a maximum of 12 piles to be cast in one operation. The forms were supported on 2 x 6-in. timbers on a spacing of about 2 ft.

A concrete designed for a minimum compressive strength of 3,000 psi. at 28 days was specified for the piles. Gravel aggregate was used and the typical mix for a 2-cu. yd. batch was as follows: Ordinary portland cement, 1,316 lb.; sand, 2,590 lb.;

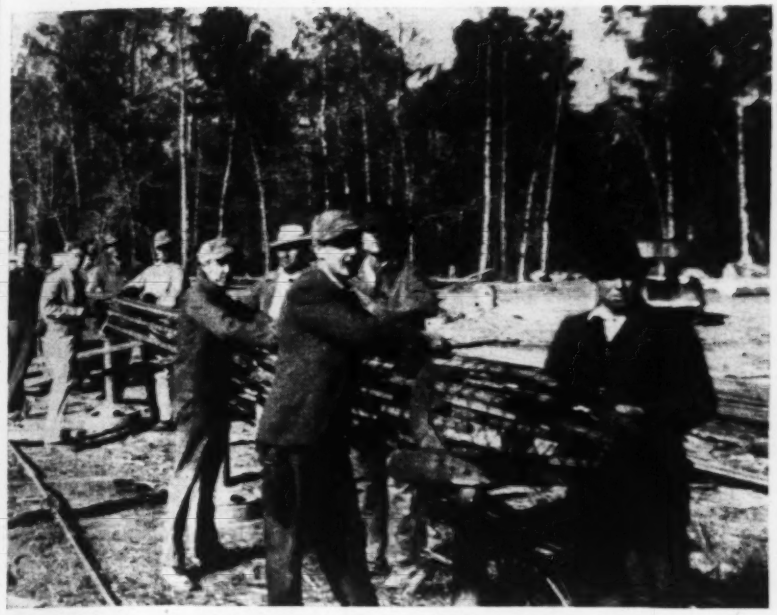


FIG. 2. THE REINFORCING CAGES for the piles were assembled with the aid of special stands. Each stand, as the right photo shows, was supported on an old truck wheel and the pivoted arms at the top were positioned with pins that could be quickly withdrawn to release a completed cage.

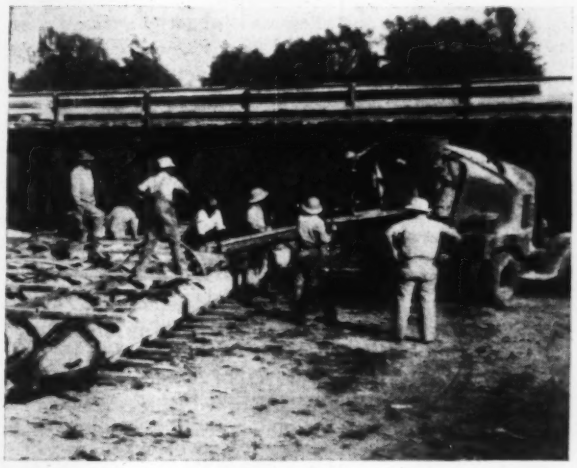


FIG. 3. CONCRETE FOR THE PILES, which were cast in steel forms, was delivered in truck-mounted mixers, the concrete being vibrated into place.

FIG. 4. In handling the longer piles at the casting and storage yards they were lifted by means of a three-point hitch by a crawler crane.

coarse aggregate, 3,304 lb., and water 78 gal.

All the concrete was delivered with truck-mounted mixers. It was transferred to the forms by chute and vibrated in place with small gasoline-driven internal vibrators. Curing was with a membrane compound. All piles were left from 10 to 14 days at the casting site and they were cured at least 21 days before driving.

Two methods of transporting the piles to the desired point along the project were followed. For a considerable part of the work the land was at sufficient height that a long trailer could be employed (Fig. 4), but for the remainder, a sled built of four 12 x 12-in. timbers bolted together and pulled by a crawler tractor was utilized. A 3-point lift of the type illustrated by Fig. 4 was employed in loading the longer piles onto the hauling rig, and a 2-point pickup for the shorter members. The lifting tongs were built special for the job.

A crawler crane equipped with a 72-ft. boom and handling leads 60 ft. long were used to drive all the piles (Fig. 1). The crane was equipped with a third power drum that provided an extra line for handling the piles. A telescoping strut was provided between the bottom of the leads and the crane. This strut was equipped with a hand-operated wratchet and pinion to permit adjustment of the strut's length, and thus the position of the leads. Steam for

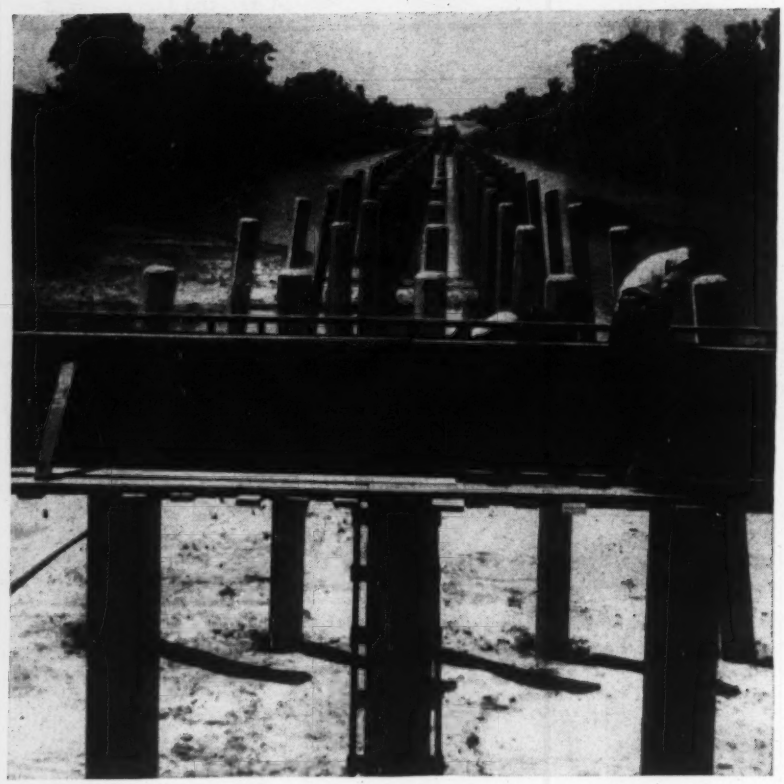


FIG. 5. BECAUSE OF THE CARE EXERCISED in driving the piles, excellent alignment was obtained. Only 16 piles had to be cut off and none built up.

the hammer was provided by a 50-hp. coal-fired boiler mounted on skids, the boiler being pulled ahead by tractor as work advanced.

Accurate spotting of the piles for a given bent was assured by use of a template consisting of two 12 x 12-in. longitudinal timbers secured to 10 x 12-in. transverse timbers with 1½-in. dia. bolts. The template was set on mud sills, which were required to keep the template level and to keep it from sinking into the mud.

Jetting aids driving

All five piles for a given bent were set in place before driving of any of the piles was attempted. Before a pile too long for the leads was set in the template, jetting was used to form a hole for the pile of sufficient depth that driving could be started. Jetting was also used simultaneously with the driving, except for about the last 16 ft. of penetration.

Two 3-in. dia. jetting pipes with 1½-in. tips were employed. Pressures as high as 150 psi. at the discharge end of the pipes were frequently used.

The jetting work not only assured rapid and easier driving, but by jetting on the correct side of a pile its position could be readily changed and excellent alignment obtained. The alignment, which was generally good throughout the job, was further improved by the driving schedule used for the piles of a given bent. It was found best to first drive one of the verticals near the end of the bent. Driving then progressed from this pile across the bent, the batter pile at the end where operations were begun being driven last.

A 5,000-lb. single-acting hammer with a 2,500-lb. ram was utilized to drive the piles for the first few bents constructed. However, this hammer proved of insufficient weight and a 10,000-lb. single-acting hammer with a 5,000-lb. ram was substituted. The latter hammer permitted a crew of four men, plus the crane operator, to drive the piles for two bents during many days and to average eight bents each 5-day week.

Experience on similar jobs had convinced the general contractor that it would be cheaper to drive a pile to cut-off level, although the bearing value was somewhat greater than that desired, than to attempt to cut off a short length of a pile after sufficient bearing was obtained. Therefore, the construction crews drove 409 of the piles to cut-off level, care being exercised in specifying the length of pile considered desirable for a given bent.

During the driving work the pile driving superintendent in charge was assisted by an engineer of the inspection staff using a Y-level to determine when the top of a pile was approaching the cut-off level. Since the presence of the engineer would normally have been required, this procedure did not increase the driving cost, although it speeded up considerably the driving operations and avoided the need for costly "cut-offs" and "build-ups" with the 409 piles.

Only 16 piles in seven bents were driven to refusal and then cut off. With these piles, which brought the total length of piling driven to 21,436 ft., the sections cut off totaled only 49 ft. Average bearing value of all the piles, which had an average penetration of 30.4 ft., was calculated at nearly 70 tons or nearly twice that required.

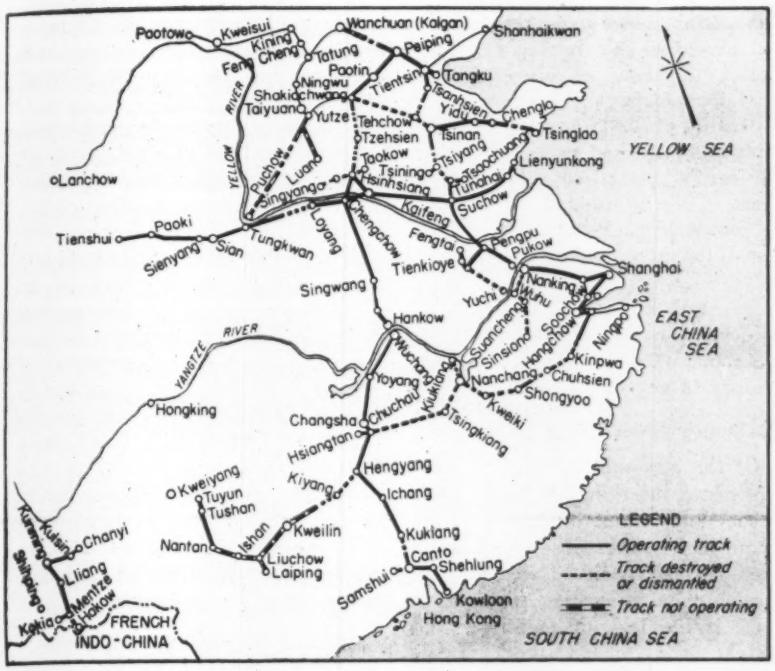
Construction of the pile caps and deck was done by conventional methods. The $1,300,000 bridge is scheduled for completion in June of this year.

Who did the work

The bridge is being built by the Georgia State Highway Department for which W. R. Neel is state highway engineer; C. N. Crocker, bridge engineer; J. Gifford Brock, resident engineer; and Vernon C. Smith, Wyatt L. Wilson, and Delmas Wheeler, project engineers.

For the Public Roads Administration, which aided in financing the work, B. P. McWhorter was division engineer at Atlanta; J. T. Smith, state engineer for Georgia, and Lyman C. Bradley and L. Silas Moore, field engineers.

Scott Construction Co., Thomasville, Ga., is the general contractor. Roy Phillips is general superintendent for this firm and Winston Jarriel pile driving superintendent. Nashville Bridge Co., Nashville, Tenn., held the structural steel contract and Carlton Contracting Co., Albany, Ga., is doing the grading and paving work for the approaches.



DESPITE APPEARANCE of a general railroad map, China has no unified railway system. The lines are nationalized but independently managed, and there is virtually no interchange of passengers and freight.

China's Transport Needs

WHEN WORLD WAR II ENDED, China's lack of transportation facilities was recognized as a critical need. Nowhere throughout the area dependent upon the rail lines can there be progress toward economic recovery from the war until the railroads are rehabilitated, at least to prewar condition; preferably to a higher standard on which it would be economical to renew and reconstruct.

These points, on which opinions are in general agreement, have served as common ground for attacking the weighty problem of where to begin and how to finance the reconstruction and other work to be done. The Chinese government shortly after the end of the war contracted with an American firm—the Morrison-Knudsen Co. —to send a group of engineers to China to survey the country's transportation needs in cooperation with the Engineering Planning Mission, a group of Chinese engineers appointed by their government to cooperate in this program. These groups were active in China through 1946, and have made reports on needed work, both in railroad rehabilitation and in port improvement and construction of new facilities.

Although these reports to the Chinese government have not been made public in their entirety, some of the findings have been made available for this summary.

As yet, the projected improvements are in the planning stage, but it is hoped that analyses and inventories recently completed have been (a) sufficient to indicate which projects should be started early to avoid bottlenecks and (b) what financial backing will be necessary to permit early start of construction on the more urgent projects.

The railroad situation today

Of the 13,400 km. of railroad on the twelve lines that were examined south of the Great Wall, most suffered war damage, some much more seriously than others.

South of the Yellow River, destruction was the heaviest because retreating Chinese troops did their best to demolish the railroad facilities they left behind and the Japanese did not succeed in making lasting repairs.

During the eight years of war to which China has been subjected there has been little or no maintenance. The resultant condition of the track itself and the lack of rolling stock and repair facilities are such that some $350,000,000 is estimated as the cost of rehabilitating existing lines. The time needed to accomplish this work would be several years after necessary materials and equipment had been made available. Moreover, because of the lack of qualified personnel it would be necessary to bring in much skilled labor and probably to give primary education (reading and writing, at least) to selected Chinese railroad workers who might thus qualify for advance to positions of responsibility on reconstruction, maintenance and operating staffs.

At present only two railroads, totaling 689 km. in length, are operating at anywhere near normal schedule. All others are too badly crippled, one way or another, to provide anything approaching normal service.

Conditions before the war

The railroads of China have been financed and built largely by foreign engineers, with foreign capital. At least seven countries have contributed to this development with loans totaling nearly $300,000,000. For the most part, each of the several lines was built for a specific purpose in one particular area. Successive projects were not planned for unified operations and thus each line remained a separate entity.

Any consolidation into a combined system would be exteremely difficult because, although 90 percent of the lines use standard gage, there are varying bridge capacities, non-standard car couplings and lack of facilities or agreements for interchange. About 60 percent of prewar freight was coal.

Six of the roads exceed 1,000 km. in length, and in several cases two lines reach the same city so that the map seems to show an extensive rail network. However it is not unusual to find that separate terminals are maintained and no physical connection exists between the two lines.

Unrepaired tracks and wrecked bridges leave much mileage inaccessible, and there is particularly urgent

need for ties. Climate, termites and mechanical wear combine to greatly decrease the life of ties in China. This problem is so serious that despite the high cost in such remote locations, creosoted ties and tie plates are recommended as economical. The one exception to this is a line where steel ties are desirable to maintain track gage on the sharp curves and steep grades of a mountainous region.

Roadbed on most of the track has been neglected for years and is generally in bad condition requiring much reballasting. This is not wholly the result of wartime neglect—in many cases the basic trouble dates further back. Whether due to lack of knowledge or because suitable material was not conveniently at hand, the ballast has been notoriously poor.

The lack of well graded ballast and frequent use of coarse material has resulted in "point support" of the ties in much of the track. Graded aggregate will be needed in the reballasting and to obtain this it would be advisable to bring in crushing and screening plants.

Because of the large percentage of bridges damaged or destroyed during the war, a specialized study of this phase of the railroad problem must be undertaken. Particularly in the case of the larger and more important crossings which will require time, the bridges might easily become a bottleneck in the rehabilitation program and are rated as deserving high priority in any planning.

Motive power and equipment

Of the approximately 2,000 locomotives on the railroads south of the Great Wall, about 30 percent were found to be either obsolete or damaged beyond repair. The most serious shortage in rolling stock, however, is the lack of passenger and freight cars of all types. Large numbers of these cars of all types will be required before any approach can be made to adequate railroad operation.

Most of the rail lines used signal systems before the war but nearly all these systems were in bad repair when Sino-Japanese fighting ended. It has therefore been suggested that when rehabilitation is undertaken, a capable crew of signal technicians be assigned successively to the various railroad lines. There are nineteen large railroad shops and a number of supplemental facilities available, including several shops built by the Japanese. Practically all of these facilities lack adequate tools and equipment: their efficiency could be greatly enhanced by modernization. This condition is paralleled in terminals and yards which are also notably lacking in many respects.

Harbor development important

The improvement of ports for ocean-going vessels is closely related to, and must go hand in hand with, railroad development. Where no adequate port facilities exist, or where they have been allowed to deteriorate by the silting up of channels and failure to maintain structures, steamers must anchor offshore and transfer freight with the aid of lighters—a slow, difficult and expensive procedure.

During the war all port improvement and maintenance work in China was at a standstill except that planned and carried out by the Japanese for military advantage. In this latter classification is the port of T'angku (near Tientsin) where the Japanese were preparing for the export of high-grade coal that can be brought to this port by rail.

The Japanese program included two 7½-mi. breakwaters, a dredged channel and wharf and dock facilities and equipment. Their plans were based on traffic estimated at about 2,000,000 tons per annum. This is believed to be much below the capacity that could be developed at this port under export supervision and with good construction equipment. However, extensive and expensive work would be involved and the construction period would be two to three years.

Shanghai, a city of more than 4,000,000 people near the estuary of

Table I--Estimates of Rehabilitation Costs on Twelve Chinese Railroads, Including Quantities of Ballast and Ties Required

	Length of Existing Railroad		Ballast	No. Ties	Rehabilitation
	Main Line (km.)	Branch Lines (km.)	Required (cu. m.)	Required	Estimate
Tientsin, Pukow	1,009	46	340,500	1,127,000	$ 4,865,000
Tsinan, Tsingtao	395	62	82,000	405,000	970,000
Lunghai	1,387	200	596,000	1,173,000	7,770,000
Peiping, Taku	183	22	25,000	113,000	1,580,000
Peiping, Suiyuan	813	59	383,000	721,000	1,875,000
Peiping, Hankow	1,214	120	869,000	1,054,000	9,085,000
Hankow, Canton, Kowloon	1,242	106	980,000	1,200,000	16,460,000
Chekiang, Kiangsi	1,110	90	2,520,000	2,325,000	19,355,000
Hunan, Kwangsi, Kweichow	1,103	93	665,000	1,820,000	13,940,000
Yunan, Indo-China	740	142	32,500	--	2,655,000
Hangchow, Shanghai, Nanking	506	32	--	105,000	5,400,000
Tungpu	598	69	?	220,000	1,150,000
Total (less contingencies and administration)					$85,105,000

the Yangtze River, is regarded as the most important seaport in China, largely because of the hundreds of miles of inland waterways tributary to its strategic location. Rated among the first eight ports of the world before the war, it handled about 43,000,000 net registered tons of shipping in 1937.

During the war this harbor was badly neglected, particularly in the matter of silting up of the channels for ocean-going vessels as well as in the loss and destruction of equipment and facilities. The present condition of disrepair in this port is one of the most acute bottlenecks in the badly disrupted transportation system of China today. The first step toward its rehabilitation is said to be the clearing of the channels by dredging, after which should come repair of old and construction of new wharves with replacement of equipment that disappeared during the war.

Despite its worldwide importance, Shanghai lacked, even before the cumulative effect of wartime neglect, any well coordinated plan for transferring freight between railroads and shipping, access to and exchange between different parts of the port itself and other developments required for efficient operation of a modern seaport.

Fortunately, in the case of this port, no new construction of a major sort (such as breakwaters, etc.) is necessary and principal needs are the redredging of the channels and rehabilitation such as will repair and replace the damage resulting from years of war and neglect. This is by no means a small matter, and even when the necessary dredging equipment and materials for construction and repairs are available the project may require two to three years.

Cost estimates

In order to include in this outline of China's transportation needs at least a general idea of the extent of the work to be done, permission has been obtained to publish a few of the cost estimates.

The accompanying table lists the estimated total rehabilitation costs on each of twelve railroad lines south of the Great Wall. These estimates include, for each railroad, more than 20 items ranging from locomotives to rail spikes. In the table, however, in addition to the cost figures, only two items, ballast and ties, are given. These two were selected from the 20 or more to indicate the great amount of work, relatively speaking, required on the track itself.

Cost estimates on work required in the two harbors, as discussed in the foregoing, were made to include (a) all work to be done with allowance for labor, materials and all incidentals and (b) the necessary equipment to be installed for operation of the facilities built. These figures are, for T'angku harbor, $23,500,000 and, for Shanghai harbor, $16,500,000.

Well-Points on Bridge Job Progress from Pier to Pier

Two state highway bridges close together on the San Joaquin River in California are carried on a total of fifteen piers that were put down in water-bearing sand under unusual difficulties. The sand is very fine-grained, the deposit is deep, and through it there is a slow but continuous flow of water.

Under these conditions the usual methods could not be used because of the very heavy pressure developed by the tendency of the soft material—almost a quicksand—to "move in." Despite this difficult condition, the work was done in only three-quarters of the contract time allowance, by use of a program in which a well-point system was moved progressively from pier to pier.

At the outset, tests indicated that the velocity of the underground flow was low enough so that inflowing water could be handled by a well-point system on close spacing. It was decided to work across the bed of the stream, moving the well points and pumps as the work advanced. Construction started on the bank where the slope was flattest. Thus, when several piers were completed and the work reached the main channel, it was possible to divert the river between previously completed piers before continuing on through the river channel.

Cofferdams were formed by driving 2-in. wood sheathing to a depth some 3 ft. below the level at which the cofferdam was to be sealed off with concrete. Cofferdams 8x35 ft. in plan were big enough for the smaller piers; areas of 18x50 ft. had to be unwartered for the abutment piers. A single 6-in. header handled the flow adequately on the smaller cofferdams, but on the larger ones it was necessary to use two 6-in. headers, each driven by a 1,500-gpm. pump with an 8-in. discharge line operating at 8-in. vacuum. Well points were put down on 2-ft. spacing from each header entirely around the excavation.

Evidence of the pressures developed by the fine-grained, water-bearing sand was given when shells for the batter piles collapsed near the lower end. This made it difficult or impossible to withdraw the mandrel. It was estimated that such a result could not be caused by pressures less than 4,000 psi.

Heavy metal for points

The difficulty was eliminated by using metal of heavier gage in the shells and welding circular beads around the corrugations in the 8 ft. of the shell nearest the lower end. Thus reinforced the boots did not collapse.

Despite the soft, water-bearing bottom, it was necessary to jet vertical as well as batter piles. The jetting process so loosened up the sand that the surface in the bottom of the cofferdam heaved even while the well points were preventing inflow of water. However, with closely spaced well points and efficient management of crews, the work was kept constantly ahead of schedule.

The work was done for the California Division of Highways, F. W. Panhorst, bridge engineer; Ralph M. Sherick, resident engineer. The general contract was held by Charles MacClosky Co., engineers and contractors, San Francisco, Walter F. Maxwell, project manager. The Raymond Concrete Pile Co. put down the piling; the well-point system was installed and operated by the John W. Stang Corp.

Diversion Factors for Combined Sewers

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Editor's Note—A method of selecting diversion factors for combined sewers based on sewage and stream analyses has been put forward by the authors (ENR Nov. 1947, vol. p. 734). Comments on and criticism of the suggested method by ten sanitary engineers appeared in a later issue (ENR March 1948, vol. p. 418). The following discussion is the author's reply to the critics.

It was with the hope of starting a "chain reaction" of development and refinement that the "balancing method" of diversion-factor design was suggested. The comments of engineers who reviewed the original article are greatly appreciated. We feel that this was the second step required for development of an accurate design method.

It is now obligatory for the authors, in the role of sponsors, to adapt the comments to their interpretation of the method. In the original article many details and associated matters were omitted for the sake of clarity and brevity. Some of these details are pertinent to the comments and are incorporated here.

Why diversion factors? No one can dispute the fact that the ideal arrangement is found when separate sewers convey the sanitary sewage and the storm water. However, many cities are served by combined sewers and under present conditions cannot afford construction of another system.

On the other hand, combined sewers are undesirable where water use requires complete separation of domestic sewage from normal surface drainage—as where the receiving stream is the immediate source of drinking water or is used for recreation.

Where combined sewers exist, a means must be devised for separation and disposal of the dry-weather (sanitary) flow. There follows the necessity of establishing criteria for the dilution required for sanitary flow before it can be diverted safely to the receiving stream. The required dilution is the diversion factor.

Why a method of computing factors? The least accurate solution of any problem is to guess the answer without supporting data. As data accumulates, accuracy increases and what was a guess becomes an estimate.

In developing a method for accurate estimation, care must be exercised to include all available data and details. Sufficient data may be lacking to develop an entirely accurate method. If an effort is made to establish an accurate method, and the procedure is put to use, that use will not only bring to light many missing details but also create a demand for more general information. Moreover, use of the method will furnish much information needed for further development.

Is bacterial pollution significant? The degree of required stream protection may be so great as to demand complete separation of sanitary and storm flows. Complete separation, of course, removes the danger of bacterial as well as biochemical-oxygen-demand pollution from this source.

Complete separation was recommended in Indianapolis, Ind. (where the balancing method was used) for portions of the sewer system flowing into a receiving stream directly above the source of drinking-water supply and a recreation area. Bacterial pollution should be the added or prime consideration when the degree of required stream protection warrants such consideration.

When water supplies at some distance downstream are considered, other aspects are involved. There is no way to provide a completely sterile stream since it is not possible to control birds, wild animals, farming, sewage-treatment plants and existing combined sewers. Reliance must be placed on the short life of pathogens in the stream and efficiency of water treatment.

Sampling of the receiving stream for *B. Coli* count, tracing of bacterial pollution to its source and reduction of contamination by any means including changing of diversion factor where required are all parts of a complete solution.

What peak flows? If a method of design is too inflexible, it cannot be expanded to cover many variable conditions met in the field. Yet if it leans too far to the other extreme, more must be left to the judgment of the individual designer and the possibility of human error increases.

In considering use of peak dry-weather sewage flows in the calculations of the BOD load in the sewer, it would not seem advisable to heap too many "worst conditions" one on another, such as worst sewer condition or worst storm. The designer must judge (based on stream requirements and physical layout of the system) whether to select the very worst condition or some lesser or average worst condition.

Since the chance of having maximum sewage load at the exact time of the most critical storm and minimum river flow is remote, a reasonable approach would be to use average summer-day maximum flow and strength of sewage.

Should treatment effluent be considered? Flexibility of design method is demanded when considering the effect of sewage-treatment effluent. Physical arrangement of the city, its streams, watersheds and interceptor system will bear upon the problem. Treatment effluent must be included in the balance for a city with

only one receiving stream and in the balance of the stream into which it discharges. When several streams converge near or above the treatment plant, successive pollution solutions including plant effluent should be made to select a critical rain for the entire area. If the city has several streams serving as overflows for interceptors and if each interceptor was designed on the basis of its own critical rain, it hardly seems reasonable to assume that each stream will have its own critical rain at the same time, resulting in all streams being loaded to capacity before reaching the treatment plant.

Basis for constants? In computing stream capacity to receive diluted sewage, certain constants must be assumed in the dissolved-oxygen deficit formula. In the "balancing method" this formula is used as a tool—the key tool and we believe it is a good tried-and-accepted tool.

Certain constants in the formula are well-established, and easily computed or readily measured. The deoxygenation constant of 0.10 is commonly used for domestic sewages and many industrial wastes. The time used in calculations, which corresponds to the bottom of the sag curve, is easily obtained by plotting the curve or by direction solution. Biochemical oxygen demand of the sewage must be first stage BOD but is usually obtained by calculation from five-day BOD tests. BOD and dissolved oxygen (DO) in the stream and rain water are obtained from samples and, unless the stream is badly polluted, are not likely to have a large influence on the calculations. Temperature of water is easily measured.

The reaeration constant of the stream must be assumed on the basis of determinations previously made on similar streams if this has not been established for the stream involved, or tests and calculations must be made to find this constant. The U. S. Public Health Service and other agencies have done a considerable amount of investigative work on the constant. It is hoped that interested parties will carry on and expand this work so that many more streams will be studied and much more data accumulated.

Other suggestions? Other suggestions have been made which are (or can be in certain circumstances) very important.

Frequent inspection, with quantitative and qualitative measurement of flows in diversion chambers, is necessary in order that the amount of diversion can be altered should the nature of sewage flow change. For the same reason checks should be made on receiving streams.

It is possible to reduce size of interceptors at the upper end by loading the stream to capacity as soon as possible below the first diversion, provided the interceptor already serves its ultimate area and population. However, all flexibility possible may be needed should these upper ends coincide with the edge of the growing city—which is often the case—since population trends cannot always be predicted accurately.

The question of sludge deposits is of great importance, particularly when the receiving body of water moves at low velocity. However, we feel that the rational method of selecting diversion factors tends to decrease rather than increase these deposits since strong sewages (usually with high suspended solids as well as BOD) produce high dilution factors, most often many times those normally assumed. Low average factors for any one stream are produced by large volumes of weak sewage in some sewers which result from unpolluted industrial cooling water or infiltration of ground water being added to the sewage flow and calling for a low diversion factor.

Due to the chain of "worst" circumstances necessary to cause the conditions of the calculations (minimum stream flow, summer-day peak in sewage flow and strength, critical rain and maximum stream temperature), the absolute minimum of dissolved oxygen permissible in the stream for the desired protection can be considered as a safe design criteria.

What's the answer? To those who say that separate systems are the only solution, we can only answer that we too believe them to be the ideal. But two sewers in every street and two sewer systems in every city are not always possible. Combined sewers possess inherent evils which obligate the engineer to make the best of a difficult situation. We hope that the "balancing method" is a realistic step in the direction of better stream conditions as well as savings in sewer-construction costs.

Blame Weed Killer for Roadside Fire

Sodium chlorate, a weed killer that the California Division of Highways has used successfully for 14 years to prevent brush fires, was blamed for a 3-day fire that recently blackened 1,300 acres of foothills in the Newhall area.

The weed-killer had been sprayed along 190 miles of U. S. highways 99 and 6 in the Newhall area and 101 in the Malibu Beach district. As soon as the Los Angeles County fire department decided that ignition of the crystallized sodium chlorate started the fire, crews set out to scrape a bare area between the highway and the roadside brush and to treat the area with calcium chloride. By Jan. 17, the entire 190 miles had been so treated.

At first it was believed that an arsonist had set the fires, which broke out in at least 20 places and it was after flames spurted up from patches of bare ground that sodium chlorate crystals were discovered.

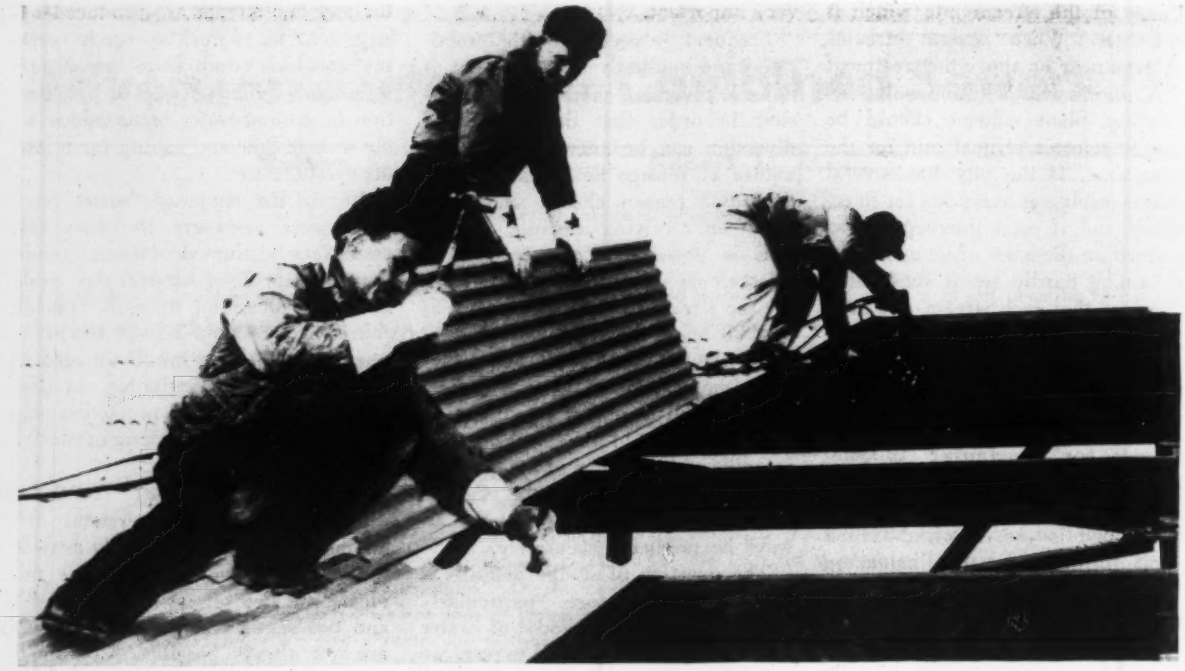
W. L. Fahey, assistant engineer for maintenance, conceded that the crystallized spray could have been to blame but said that spontaneous combustion of sodium chlorate is impossible.

William Olsen, assistant maintenance engineer for the Los Angeles County highway department, which has also used the sodium chlorate successfully for years, agreed that a spark from some external agency was necessary for ignition.

Sodium chlorate is sprayed in the winter, when rains can be expected to wash it into the soil, where it attacks the weed roots.

"This year," Fahey explained, "we have had little or no rain. That, coupled with the low humidity and high temperatures, apparently rendered the stuff dangerous."

No fires along area scraped and sprayed with calcium chloride, applied in the same proportions as the sodium chlorate, have been reported.



WORKING TOPSIDE, roofing crew erected sheet metal roofing by new method involving welded studs for anchorage.

Welded Studs Cut Costs and Speed Work On Corrugated Metal Roofing Job

Robert C. Friedly

Manager, Construction Division, Nelson Stud Welding Corp.
Lorain, Ohio

METHODS OF APPLYING corrugated sheet metal roofing and siding to large building construction have seen little change since such roofing was first developed. They have always been tedious operations, usually requiring men working from both sides of the roof to secure it to the steel purlins. This ordinarily involves erection of expensive scaffolding for working on the underside, while other members of the roofing crew are working topside.

One answer to reducing the cost of applying corrugated sheet-metal roofing has been to find a method whereby the entire roof could be laid from the topside only. A method of fastening, developed during the war for the shipbuilding industry, has been adapted to apply sheet metal roofing that enables the roofing crew to do all the work on the topside. Used recently for the first time on a large construction job in Birmingham, Ala., this method produced successful results by reducing direct application costs more than 50 percent. It involved the use of a special welding gun, developed by the Nelson Stud Welding Corp., which end-welds rivets to the steel purlins. The corrugated metal then is impaled over the rivets, which are upset and rounded off to form a weather-tight job.

Eliminates scaffolding

Since the construction of this industrial building in Birmingham involved 4,000 squares (400,000 sq. ft.) of corrugated sheet metal roofing and siding, economies that could be effected in its erection were an important item.

The job was started using the conventional method of steel straps and rivets to secure the roofing to the steel purlins. But by converting to the new method of end-welding rivet studs which eliminated scaffolding, the contractor reduced his direct application costs more than $2.00 per square over methods previously employed. Moreover, with this new method and two additional men, the roofing crew could erect the roofing and siding 2½ times as fast as by the conventional means.

The special welding gun used on this job weighs only 5 lb. It is simple to operate, and end welds studs to steel with great rapidity. Studs are

SHORT STUDS FOR ANCHORING ROOFING are welded to top flange of purlins with special lightweight gun (left). Joints in roofing were made weather-tight by upsetting and rounding-off protruding ends of welded studs, using a machinist's hammer and rivet-set (right).

located accurately by a special lightweight template.

In this method of erecting corrugated sheet metal roofing, the welder first shoots the rivet studs through the template into position on the steel purlins. Then a member of the installation crew places the corrugated sheets in position; a sheeter drives the rivet-extensions through the corrugation crown by striking the metal with a rubber hammer at each stud location, and another sheeter follows with a rivet-set and machinist's hammer to upset and round-off the rivet.

The corrugated-metal roofing is neither torn nor damaged, and rounding-off the rivet provides a weather-tight job.

Savings effected on the Birmingham job resulted from a number of factors. First, it provided a completely topside method of roofing—all members of the crew worked on the top of the roof only.

In addition to the 50-percent direct application cost saving, there was thus a saving in cost of scaffolding equipment and its erection. Also, there was no interruption to other construction crews working on other phases of construction such as frequently occurs when scaffolding is erected under the roof structure.

Another advantage is that the various roofing operations can be readily divided—the division of functions puts the job on a production basis. On this particular job, seven men comprised the roofing crew. An added advantage, pointed out by the contractor, is that there are no fastening devices or straps to mar the interior appearance of the roof, or to interfere with maintenance painting of the purlins. The appearance of the completed roof from both topside and underside is neat and clean.

Simplified welding procedure

Operation of the welding gun is simple, as long as a few basic rules are followed. The welding time interval is regulated by a timer control box which is part of the equipment. This timer control is set only once for the ordinary job. To make the weld, an operator inserts a flux-filled stud into the chuck of the gun and adjusts a porcelain ferrule in the proper position around the stud.

He next places the stud against the steel purlin with sufficient pressure to hold the leg of the gun securely against the purlin. Pressing the trigger button on the gun then automatically lifts the stud from the plate and establishes an electric arc. The timer control automatically disconnects the welding current at the proper time, and the gun's mainspring forces the stud into the pool of molten metal to complete the weld. The entire weld cycle is automatic, with the weld being made in less than one-second.

The welding gun operates from a standard d.c. welding generator of a rated capacity suitable for welding the size of the stud required for the job. Rivet studs of different sizes are manufactured for the various gauges, types and number of layers of corrugated metal being erected, although generally only two sizes are needed for the average job. On this particular job, a $\frac{5}{16}$-in. shoulder-type stud was used, having a length of 11/16 in. to the shoulder, with ordinarily a 3/16-in. extension. Length of the extension was $\frac{1}{2}$ in. at corners where four layers of roofing were lapped. Side laps between the purlins were secured by self-tapping screws.

Nick & Hendon Company, Ensley, Ala., were the roofing contractors on the project.

California Must Conserve Water

CALIFORNIA'S WATER SUPPLY, depleted by years of heavy demand, reached a critically low stage this spring after very light precipitation during the past winter. In the four months from November to February, inclusive, the precipitation approached the all-time minimum, and by the first of March—near the end of what is usually the season of heavy rainfall—the situation was so critical that statewide emergency measures were adopted. Not only was a water shortage imminent, but electrical energy was being rationed and there was prospect that the restrictions would have to be made much more severe.

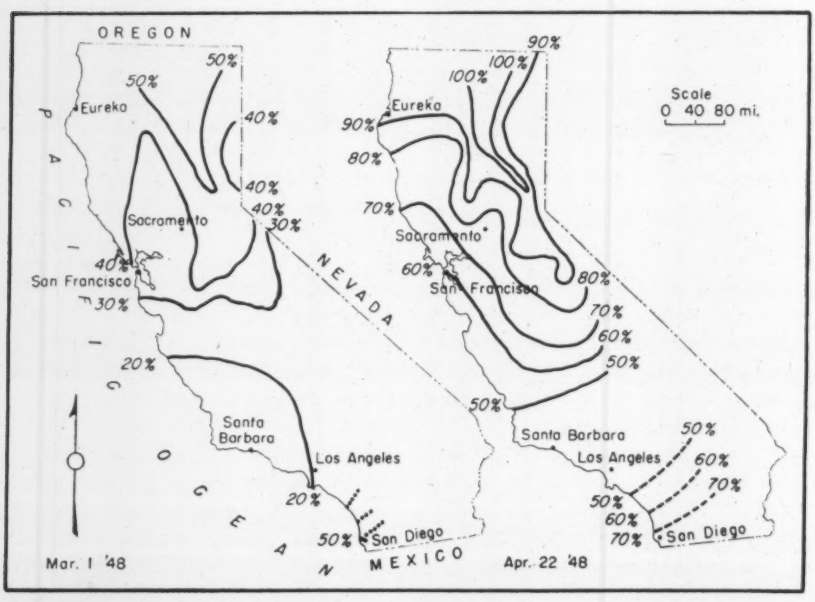
Even farmers producing essential foods were required to cut their use of power for pumping irrigation water by 20 percent. To reduce the use of current for lighting, daylight saving was put into effect by proclamation of the governor; a power administrator's office was set up to screen all applications for new power service, and strict water rationing to effect a 10 to 20 percent saving was enforced in the communities most seriously affected.

While these emergency measures were being put into effect the situation was relieved materially by a series of storms. During March and April copious rains and snow fell on much of the state with the result shown graphically in the accompanying maps.

While the disturbing prospect of an extremely critical water shortage this year was thus happily eased, there was little effect on underground storages. Many years of increasingly heavy draft on underground supplies has left them in a serious state of depletion. Hence the fundamentals of the situation outlined in the following are receiving careful study with a view to planning further development and conservation of the state's water resources.

The statewide aspect

California's water problems vary so much with location that averages mean little. Elevations in different parts of the state range from below sea level to more than 14,000 ft. "Normal" rainfall ranges from less than 2 in. in Death Valley to 109 in. in Del Norte County. With such diversities, the several natural divisions of the state must be considered independently.



RELIEF FROM LATE RAINS is shown by these state maps on which total precipitation as of successive dates is plotted as percentages of seasonal normals.

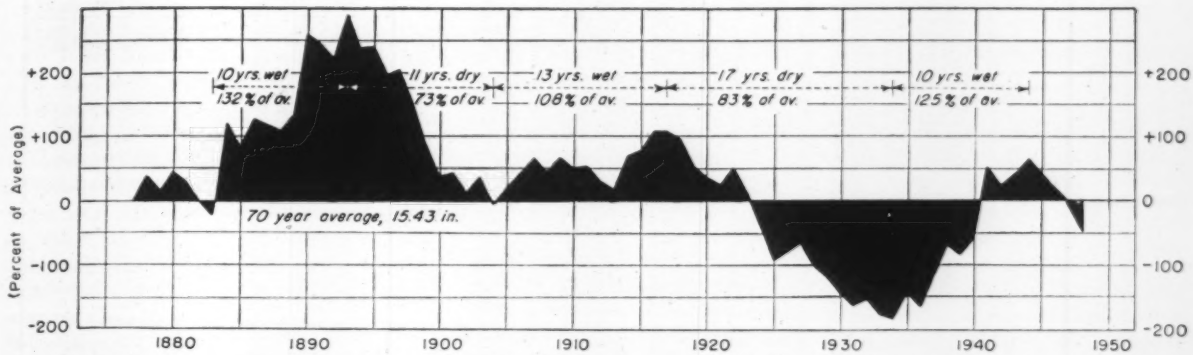
Charles L. Kaupke, water master of the Kings River Water Assn. and an authority on water resources in that part of the state, cites figures to show that even now, at a time when the San Joaquin Valley is emerging from a wet period, heavy overdraft is being imposed on underground storages. The cause is not low rainfall but (1) the steeply rising increase in water demand due to increased population and (2) current high prices for farm products that have encouraged irrigation of submarginal land and lifting water from greater depths.

A parallel view is held by Prof. Franklin Thomas, California Institute of Technology, who says that long-term rainfall records in southern California indicate that normal projection of the present precipitation curves gives "good reason to expect that the season of 1948-49 will provide above average rainfall to be followed by from 5 to 10 years of less than average precipitation."

Prof. Thomas permits us to reproduce a "residual mass diagram," representing accumulation of seasonal rainfall excesses or deficits in comparison with the average for the past 70 years. This chart shows wet and dry periods of 10 to 17 years following each other successively. The present (terminal) slope of the curve marks the fourth time that four successive years of subnormal precipitation appear in this 70-year period.

Professor Thomas is of the opinion that the major areas in California can eventually be furnished with an adequate water supply. For example, the Colorado River aqueduct will provide enough water to put 1½ acre-ft. per year per acre on the entire south coastal plain area. This is enough, he says, to supply ultimate agricultural and domestic needs, on the basis that fourteen people can live on an acre of land with this much water if 129 gal. per day is the requirement per person. Assuming four families per acre, this would give each family an area of about 100 x 100 ft.

In commenting on estimates of the cost of importing Columbia River water into California's Central Val-



ACCUMULATION AND DEPLETION OF RESERVES is shown in residual mass diagram of rainfall at Los Angeles.

ley, Frank E. Bonner, formerly executive secretary, Federal Power Commission, said that California will find it cheaper to distill ocean water than to import water from the Columbia. Distillation schemes have been proposed repeatedly, but thus far have been too expensive. However, serious research on this subject is now under way at the University of California.

Other suggestions concerning maximum development of available water include salvage of drainage water from irrigated areas and the reclamation and purification for irrigation use of the flow in large outfall sewers.

Precipitation this season

While late rains this year brought much more than the usual spring precipitation, they left a few areas without a safe margin of storage. The ground was so dry that where there was anything less than copious rains there was no immediate runoff. In the parched Santa Barbara area, Gibraltar reservoir gained only 100 acre-ft. Along the Sierra Nevada Mountains low temperatures brought the snow line down and thus retarded reservoir gains.

One outstanding exception to small surface-storage gains was Shasta reservoir. This filled rapidly during the late storms, and early in April the Bureau of Reclamation began to release water in addition to the flow through the turbines. This was necessary in order to take account of the event of further heavy runoff.

Snowfall that comes late in the season, as it did this year, may be very deceptive, it is pointed out by snow survey authorities. This year the snow at Donner Summit (an observation station in the Sierra at El. 7000) increased from 23 in. on March 12 to 110 in. on March 25, thus exceeding the depth at any time during the winter of 1946-47. However, this late snow though deep, is not packed. Surveys show the 110-in. depth to contain only 27 in. of water as compared to the 29 in. of water in last year's pack of 61 in.

Depleted underground storage

The late spring rains relieved the critical situation in two ways, by stopping unseasonal draft on the dwindling supplies in storage and by putting a stop to pumping for irrigation. However, the late rains had relatively little effect on underground water storage which has been quite generally receding in recent years.

In areas of the Sacramento Valley where ground water levels in recent years have been at an average depth of 15 to 40 ft., the withdrawals of the past year lowered these levels 2 to 6 or 8 ft.

In the upper San Joaquin Valley mean depth to ground water is much greater, excluding the Fresno Consolidated and Alta districts, depths range from a minimum of 10 or 15 ft. up to 200 ft. or more. Here the total area of 22 districts aggregates 2,230,000 acres. Of this total 336,000 acres have a pumping lift of more than 150 ft.; one 27,000-acre area involves a 271-ft. lift. Throughout this upper San Joaquin region, where irrigation water comes from deep water tables, the withdrawals from October, 1946, to October, 1947, lowered the level by more than 8 ft. in 10 of the 22 districts.

Notably at Santa Barbara and throughout southern California, water tables that have lowered but little under the withdrawals of previous years, showed considerable recession in the Oct. '46-Oct. '47 season.

A practice followed with good success in several basins is the storage of flood waters to be later spread and sunk into underground areas. An example of this is the system of five dams (with commitment made on a sixth) of the Santa Clara Valley Water Conservation District constructed exclusively for this purpose. These dams, which have been in service since 1936-37, have greatly relieved the water situation not only by protecting lands that were in danger of having wells go dry, but in reducing the pumping lift on practically all of the irrigated area.

Salt water incursions

Incursion of salt water from the ocean into underground storage basins is considered a serious menace in several of the southern California coastal areas. The danger lies in continued pumping from wells of a basin already drawn down to sea level. In some of these areas, as in Orange County, unbroken aquifers that pass through impervious strata to the ocean, have long served as outlets for discharging fresh water. But they can transmit sea water landward if the water table inshore is drawn down to or below sea level. Some of these aquifers pass through what is referred to as the "barrier" between the ocean shore and inland underground storage basins. Some of the latter extend well below sea level. It is apparent that the encroachment of sea water to and past this barrier is undesirable.

Long-time if not permanent injury to these underground water storages is now threatened by the advance of salt water toward low points in the subterranean barrier. Records of water table levels in Orange County

dating back to 1880 show that underground water lowered about 40 ft. in the 1880-1900 period. The level then remained about static until 1918. There was a decline of some 70 ft. from 1918 to 1936 and then a recovery of 17 ft. between 1936 and 1945. The two periods of decline were periods of deficient rainfall.

With underground storage thus drawn down, contamination from salt water began to be noted. The first of this came from the landward movement of connate water (entrapped sea water) that was native in the Pleistocene deposits. This caused contamination up to about 1,000 ppm. of chloride and 2,000 ppm. of all solids. In a later stage of ground water drawdown in this area it was found that ocean water was moving inland 0.3 to 0.7 miles behind the front of the advancing connate water. If this inshore movement passes beyond the "barrier" lip, the ocean water "could invade the deeper water-bearing zones of the coastal plain and spread widely and to depths of several hundred feet," according to a report on Santa Ana ground water conditions, dated last fall, by J. F. Poland, district geologist, U. S. Geological Survey, Long Beach, Calif.

For the past eight years the U. S. Geological Survey has been investigating problems of saline encroachment along the shore of the coastal plain in Los Angeles and Orange Counties. Some thirteen reports have been published on findings of these studies dealing with areas from Santa Monica on the north to Santa Ana on the south.

One of the areas under careful examination has been the west basin area of Los Angeles County where the water table is now as much as 75 ft. below sea level and salt water encroachment has advanced inland almost 2 miles from the coast between Redondo Beach and El Segundo.

A special census of California population, taken by the U. S. Census Bureau, brings records up to the latter part of 1947 and in some areas up to early 1948. As compared with the 1940 census, these later figures show that in the 7-year period, during which the population of the United States as a whole increased less than 9 percent, California's population increased 43 percent, bringing the total to about 10,000,000 people.

Whether recent population increases will continue, and how extensive the effect will be on water resources, are matters of conjecture. Tangible facts, on the other hand, are that the extremely rapid population increase is having a marked effect on the supply of water for domestic, industrial and irrigation purposes. The situation is therfore receiving careful study by all agencies concerned with the future of the state's water resources.

WATER STORED IN SIERRA NEVADA RESERVOIRS ON MAY 1, 1948

Watershed	Reservoir	Capacity Acre-Ft.	Water in Storage (Acre-Ft.) May 1, 1947	1948
Sacramento	Shasta	3,806,000*	3,091,000	3,741,000
Feather	Mountain Meadows	24,000	23,100	24,000
	Lake Almanor	649,800	597,300	484,300
	Bucks Storage	103,000	97,600	71,000
	Butt Valley	50,000	32,600	45,000
Yuba	Bullards Bar	10,800	10,800	10,800
	Bowman Lake	68,000	38,500	19,200
	French Lake	12,000	5,000	3,500
	Scotts Flat	26,800	.....	20,500
	Spaulding System	150,000	99,200	109,900
	Narrows	45,000	45,000	45,000
Bear	Combie	7,180	4,800	7,180
American	Twin Lakes	21,300	11,100	7,900
	Silver Lake	8,900	7,200	3,600
Mokelumne	Salt Springs	139,000	64,900	51,700
	Pardee	210,000	170,700	198,700
Stanislaus	Relief	15,100	7,000	3,400
	Strawberry	17,900	15,100	9,400
	Melones	112,500	102,600	100,100
Tuolumne	Lake Eleanor	26,000	24,400	24,300
	Hetch Hetchy	340,000	119,100	74,900
	Don Pedro	260,000	231,800	217,900
	Owen	49,000	23,400	40,700
	Dallas Warner	27,000	13,000	23,200
Merced	Lake McClure	281,000	228,000	165,600
San Joaquin	Crane Valley	45,400	40,400	27,410
	Florence Lake	64,400	1,000	400
	Huntington Lake	88,800	61,300	37,500
	Shaver Lake	135,300	12,500	35,900
	Millerton Lake	520,500	331,400	192,600
Total For 30 Reservoirs		7,314,680	5,509,800	5,796,590

* 3,806,000 area-ft. is capacity to top of temporary flashboards. (Capacity to spillway crest is 3,714,000 area-ft.).

State Requirements For Airport Construction

Some 31 states have passed legislation to permit a state aeronautics agency to construct airports, according to a special survey by the Civil Aeronautics Administration. In some cases the aeronautics body is an agency set up especially for the purpose of constructing and operating airports. In other states, such as in Georgia the state highway board has been named, while in Indiana the state highway commission has been designated.

In all but seven states, county governments have been given the power to construct and operate airports, the CAA also reports. Municipalities may also construct and operate airports in all states except Rhode Island, where the state rather than the cities builds and maintains airfields.

If federal funds are to be used in financing an airport project, 23 states require that the projects be approved before the work can be carried out. Twenty states also require that federal funds be channeled through the proper state organization, and in 19 states this method of distribution is voluntary.

State supervision of construction on federal-aid projects is mandatory in six states regardless of whether any state funds are used, and in two other states this method is mandatory only if state money is involved. A total of nine states have legislation that permits voluntary state supervision of construction.

READER COMMENT

New Venturi Tube Defended

Sir: The writer anticipated some lifting of eyebrows from those concerned with the manufacture and sale of conventional Venturi tubes. He appreciates the comments by Messrs. Richardson and Borden (*ENR* June 24, Vol. p. 1040). Out of such comes progress.

Mr. Richardson mentions throat velocities "up to 35 fps." and Mr. Borden writes of "velocities greater than 100 fps." with flat coefficient curves. Cavitation can result, and doubtless does, under such high velocities without materially affecting the discharge coefficient. When water heads are balanced by mercury, throat velocities have to be high in order to obtain a measurable differential for low flows.

The writer has developed a recording device for manometers in which the differential head can be kept down to 5 ft. or less of water regardless of line pressures and in which no mercury is used. The result is a recording device that is 13.56 (sp. gr. of mercury) times as sensitive as a mercury manometer. High throat velocities therefore are neither necessary nor advisable.

Some of the users of the "simpler" tube are listed in the writer's article. Every one of these recorders is operated by water columns—not mercury. One has been in operation for five years without repair or adjustment. The differential head varies between 3 and 8 in. of water, and of course, throat velocities are low.

Mr. Richardson asks, "Must the new tube be designed, eventually, for using only a water manometer and low differentials?" If he refers to the "simpler" tube the answer is *yes*, and regardless of the pressure.

Objection was made to the formula given in the writer's article and rightly so. It should have been

$$Q = cKd_2^2 \sqrt{\Delta h}$$

Then K depends on the diameter ratio only and is independent of d alone, which it should be. It is so given in King's Handbook of Hydraulics.

The writer has been connected with the use of the conventional Venturi tube as a precision meter in hydraulic-laboratory practice. Orifices and nozzles in pipes were also used for the same purpose. Virtually all such devices, however, were calibrated in place volumetrically. No recording devices were used. Only indicating manometers—generally with open water columns or sometimes with a manometer closed at the top and filled with a light immiscible liquid on top of the water—were employed. This arrangement is most sensitive to very slight differential heads.

It is a far cry from the use of such precision usage of Venturi tubes to that of commercial tubes using mercury to actuate recording, indicating and totalizing devices. Under such circumstances precision is seldom an important objective and results within 2 to 3 percent are acceptable. It is believed the "simpler" tube with its new recording device will meet that demand and at considerable saving over the conventional tube with mercury actuated recorder.

J. C. STEVENS
Consulting Engineer
Portland, Ore.

Cut-and-Fill Formula

Sir: Solutions for the problem proposed by Mr. G. P. Wyland in "Comment and Discussion" *ENR* May 13, 1948 may be found in Civil Engineer Pocket-Book, Frye, D. Van Nostrand; Railroad Construction, Webb, John Wiley & Son; Route Surveying, Rubey, MacMillan Co.; and no doubt in many other texts. The solution by Rubey is perhaps the simplest, requiring only multiplying factors for various cut slopes and transverse ground slopes to apply to level volumes obtained from tables of level triangular prisms.

The area in fill or cut for any cross slope is always greater than that for the level section having the same center height. Let this surplus area be K and the level area be A_L. Then the ratio of increase is

$$R = \frac{K}{A_L}$$

The area of the actual section is

$$A_L + RA_L - \textit{Grade Triangle}$$

In tabular form, Ruby gives values of R (plus one) for usual cut or fill slopes and various transverse slopes, but he does not give the formula for R. Let a = angle the side slopes make with the horizontal (cotangent of this angle is the customary 1:1, 1½:1, etc.) and d = the angle the transverse ground line makes with the horizontal. Then,

$$R = \frac{1}{2} \frac{\sin^2 d \sin 2a \cot a}{\sin (a + d) \sin (a - d)}$$

If $a = 45$ deg. ($s = 1{:}1$) the above is simplified to

$$R = \frac{\text{exsec } 2d}{2}$$

R. D. GLADDING
Cia. Vale do Rio Doce S.A.
Rio de Janeiro, Brazil

Sir: The item in *Engineering News-Record* on page 93 of the May 13th issue interested me. A cut-and-fill area formula for a 3-level section was requested. In reply, I suggest that the least cumbersome formula for the conditions stated in the problem is

$$A = \frac{50}{91}\left(H_1\sqrt{3} + \frac{W}{\sqrt{3}}\right)^2 - \frac{W^2}{6}$$

A. H. DAVISON
10 Broad Street
Glens Falls, N. Y.

Sir: In your issue of May 13, vol. p. 725, Mr. G. P. Wyland suggests a need for a formula for areas of cross sections in cut and fill problems. Formulas in terms of the horizontal and vertical distances to side stakes (a, b, c, and d of Mr. Wyland's figure) are available in texts dealing with earthwork. For example, the area may be written:

$$A = \frac{1}{4} W(a + b) + \frac{1}{2} H_1(c + d).$$

A formula which does not depend on side stake distances can be derived as follows. Choose the origin of coordinates at the intersection of the side slopes of Mr. Wyland's figure. Let m = the side slope, p = the ground slope, and b = the y-intercept of the ground slope line (y assumed positive down). The equations of the side slope lines in the first and second quadrants, and of the ground slope line, are then respectively:

$$y = mx, \quad (1)$$
$$y = -mx, \quad (2)$$
$$y = px + b. \quad (3)$$

The intersection of the lines repre-

sented by eqs. (1) and (2) is at the point $\left(\frac{b}{m-p}, \frac{mb}{m-p}\right)$. The intersection of the lines represented by eqs. (2) and (3) is at the point $\left(-\frac{b}{m+p}, \frac{mb}{m+p}\right)$. From the formula for the area of a triangle in terms of the coordinates of its vertices, we have, for the triangle formed by the side slopes and the ground slope,

$$A' = \frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ \frac{b}{m-p} & \frac{mb}{m-p} & 1 \\ -\frac{b}{m+p} & \frac{mb}{m+p} & 1 \end{vmatrix} = \frac{mb^2}{m^2-p^2}.$$

From this area there must be subtracted the area of the triangle above the roadway. With side slope m and roadway width W this area is found to be $\frac{1}{4}mW^2$. Therefore,

$$A = \frac{mb^2}{m^2-p^2} - \frac{1}{4}mW^2. \qquad (4)$$

EDWIN H. GAYLORD
Chairman Department of Civil Engineering
Ohio University
Athens, Ohio

Matilija Dam Troubles

Sir: The article "Horizontal Shear Plane Separates Gravity and Arch Sections of Dam" (*ENR* June 10, vol. p. 958) descriptive of some of the features of Matilija Dam, Ventura County Flood Control District, California, is interesting chiefly for the facts which have been left unsaid. The reader would hardly suspect the fury of the controversy now raging over this project, or the fact that the State Division of Water Resources has not permitted storage of water in the reservoir above Elev. 1050 (spillway crest Elev. 1125); that the engineers resigned upon request and are now defendants in an action filed by the flood control district for the recovery of damages in excess of one million dollars; and that the entire subject gives promise of becoming a major scandal in the engineering profession.

The article gives the impression that the chief cause of the notable increase in cost from an original estimate of $800,000 (actual figures submitted to voters in the bond election $682,000) to over $2.200,000, were increased thickness of the abutments and additional grouting, which is far from the truth. Many factors contributed to the increase, including introduction of the shear plane subject of the article, which was not contemplated in the original design and only added at the insistence of the State Division of Water Resources; and very substantial increases in quantities as compared with those used for the comparison of bids, which were based on guesses as to the elevation and suitability of the rock. Another important single item was the mining out and replacing with concrete of the soft gouge and crushed rock of a steeply dipping slip plane on which some of the blocks of the left abutment had been founded. This was a rather extensive structure and not a "soft lens of shale" as mentioned in the article.

No doubt, ultimately, volumes will be written on the subject of Matilija Dam. One can appreciate your reluctance to delve too deeply into the matter prior to adjudication by the courts, but there are many points in connection with the investigation, design and construction of this project which are certain to be of great interest to engineers as well as to the public in general.

RANDALL CREMER
Vice-president, Frederick Snare Corp.
Ojai, California.

Flood Warnings

Sir: In the editorial in your June 24 issue, "Flood Warning Responsibility," the conclusion is drawn that a lesson with respect to flood warnings should be taken from the Columbia River disaster as the situation "applies equally to every other stream in the country." This point is well taken.

In this connection, it may be of interest that some 10 years ago the U. S. Weather Bureau and the Tennessee Valley Authority developed a cooperative plan for issuing information that would keep the public advised of the water-control operations of TVA projects and also of flood heights to be expected on important tributary streams which are unregulated and have no flood control works.

The operation of the TVA projects requires continuous forecasting of flows in streams all over the Tennessee Valley in order to determine inflows into the TVA reservoir system. The water must be dispatched through the reservoir system so that it effectively controls floods, aids navigation, and produces power. These operations inherently provide the information needed for flood and river forecasts.

In making predictions of future stream and reservoir stages, the TVA engineers are furnished twice daily, and more often during critical flood periods, predictions of quantitative rainfall to be expected. Reinforced by personal consultations between TVA engineers and Weather Bureau meteorologists, such advance rainfall forecasts are taken into account in predicting stream flows and in the release or storage of water from the TVA reservoirs. River predictions are made for three days in advance.

TVA recognizes the responsibility of the Weather Bureau to disseminate flood and river information to the public. Accordingly, all needed information is furnished to the Bureau which in turn supplies this to the press and to radio stations from one end of the Tennessee Valley to the other. Special bulletins covering TVA project operations, such as how the spillways and sluices at various dams will be operated, are furnished to the press by the Weather Bureau. Daily cooperative bulletins are issued by mail. Weather Bureau officials broadcast from principal radio points several times daily as a matter of routine and more often when rivers are at flood stage.

During the greater part of the year when there are no floods, river and lake stages are issued to press and radio by the Weather Bureau to meet the demand of navigators and a large segment of the general public interested in boating and recreation activities.

As a result of this coordinated service of supplying river information to the general public, experience has shown that flood losses have been held to a minimum on uncontrolled streams. The pattern which has been developed and which is in operation in the Tennessee River Basin is successfully accomplishing its objectives and may serve as a guide to solving the problem of flood warnings on streams throughout the country.

ALBERT S. FRY
Chief, Hydraulic Data Branch
Tennessee Valley Authority
Knoxville, Tennessee

BOOK REVIEWS

Building Design

PLANNING INDUSTRIAL STRUCTURES—By Clarence W. Dunham. 481 pp. McGraw-Hill Book Co., New York 18, Toronto and London. $6.

Before numerical calculations are made, the most important stage in the design of a building generally has been completed. This phase, which is the subject of Prof. Dunham's book, involves the determination of basic elements, such as location, size and shape of structure, materials of construction, framing schemes, types of members and principal architectural features. In presenting the principles of planning industrial structures, the author offers many practical suggestions. He demonstrates the influence of building materials on design and gives typical constructions. He also discusses planning for proper lighting and ventilation, the effect of soil conditions on design and the bracing of buildings.

Panama Canal History

AND THE MOUNTAINS WILL MOVE—By Capt. Miles P. DuVal, Jr., USN. 374 pp. Stanford University Press. $5.

This review of Panama Canal history, compiled from many sources, describes the financing and construction of the Panama Railroad, 1849-1855; devotes about one-third of the book to the 1879-1889 period in which the French struggled with Isthmian Canal problems and gives detailed attention to the ups and downs of the great undertaking in the 1904-1914 construction period under the three successive chief engineers, Wallace, Stevens and Goethals.

The work is a fully documental text. The author was stationed, from March 1941 to June 1944, in the Canal Zone as captain of the Port of the Pacific terminal of the canal where he had access to much reference material. Evidence of his study of records appears in the plethora of quote marks throughout the text and, on almost every page of the book, footnote references to sources. The author's attention to detail in the period of the French activities on the Isthmus of Panama brings out the importance of the DeLesseps initiative and enthusiasm and the great amount of preliminary work done under this leadership—work on which our engineers later had complete records.

The book presents the intimate details leading up to untimely resignations from an uncompleted project by the first two chief engineers, Wallace and Stevens—events that can be seen to best advantage only with long range perspective such as this author has. Also included, as a complete inside story, is the account of how President Theodore Roosevelt finally selected an Army engineer (Goethals) to complete construction.

This book is the second in a trilogy by the same author. The first was "Cadiz to Cathay" and the third, now in preparation, will be "The Future of the Panama Canal."

Columbia's Experiment

TRENDS IN ENGINEERING EDUCATION: The Columbia Experience—By James Kip Finch. 140 pp. Columbia University Press. $2.

Dean Finch writes lucidly, and since he has been in close contact with the effort made at Columbia to develop a system of engineering education that would be adequate for the expanding needs of the engineering profession, his appraisal of what has been accomplished since a six-year course was inaugurated in 1914 is well worth reading by anyone who is at all concerned with present trends.

Under the plan now in effect at Columbia the pre-engineering student has two years in the arts college, where he can switch at any time from pre-engineering to pre-law or pre-business. The next two years lead to a bachelor of science degree, after which the student can work a fifth year for his professional degree (C.E. Ch. E.) or two more years for his master's degree.

Concerning this arrangement, Dean Finch says: "We have decided that four years is long enough for the first engineering degree and that time is available in four years for a well-balanced fundamental undergraduate program of studies. This involves, of course, quite ruthless elimination of older options. . . . If a student is well trained in hydraulics and structures, knows the basic facts of hydrology and has an understanding of economic values, he can certainly study any text we have seen on public water supply with comparative ease and complete understanding. Not so with the theory of elasticity or statically indeterminate analysis—and he needs a basic understanding of these subjects today if he is to be more than a 'handbook' engineer."

Dean Finch's discussion of graduate instruction and of the needs of engineering science are especially stimulating.

Stress Analysis and Design

ELEMENTARY STRUCTURAL ANALYSIS—By John B. Wilbur and Charles H. Norris. 523 pp. McGraw-Hill Book Co., New York 18, Toronto and London. $6.

STRESS ANALYSIS AND DESIGN OF ELEMENTARY STRUCTURES—Second Edition, by James H. Cissel. 419 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $5.

Both books present basic structural theory for use in undergraduate courses, but the second, which covers structural design as well, is intended primarily for use in structural courses given to other than civil engineering students. In the first book, consideration is given to the analysis of structures by means of models as well as by mathematical and graphical methods. A feature is the presentation in a chapter on approximate analysis of indeterminate structures of Professor Wilbur's "Factor Method" for analyzing building frames acted upon by lateral loads. The second text has been revised to include current code requirements and a chapter on the design of light-gage steel structures. However, some of the material on welding appears to be a bit ancient.

About James B. Eads

ROAD TO THE SEA: The Story of James B. Eads and the Mississippi River—By Florence Dorsey. 340 pp. Rinehart & Company, New York and Toronto. $4.

James B. Eads' name brings to the mind of many engineers the picture of a graceful bridge spanning the Mississippi at St. Louis, a bridge where he pioneered in steel arch construction and in deep pneumatic foundations. But Eads' versatile mind made an equally notable contribution to engineering progress through development of a method for forcing

the Mississippi River to maintain a navigable channel through the South Pass of its delta and in the design of gun boats used in the Civil War. Had death not ended his career suddenly at the age of 64, it seems probable that his name might also have gone down in history as the builder of a ship railway across the Isthmus of Tehuantepec in Mexico.

How Eads planned and built his two great engineering works and many smaller ones is told in this new biography. Miss Dorsey has written a very readable and inspiring account of a man, who handicapped by a none too rugged constitution and no formal schooling, advanced to place in the front rank of engineering.

The satisfaction that engineers find in this record of remarkable accomplishment must be tempered by Miss Dorsey's recital of the obstacles that other engineers, notably General A. A. Humphreys, the then Chief of Engineers, U. S. Army, put in Eads' way. Even after making allowance for the author's desire to build up her hero, those parts of Miss Dorsey's carefully documented record that tell of the ends to which General Humphreys and a few other engineers went to block his pioneering work are not pleasant reading.

Miscellaneous Notes on Booklets and Reprints

WOODEN WELL SCREEN AND FILTERS for Enid, Grenada and Sardis dams are the subject of investigation reports just issued. Tests on different shaped holes in wood pipe showed that slots or circular holes were equally satisfactory. Laboratory tests on filter material resulted in selection of three types of gravel for differing soils. Booklets describing the investigations are "Laboratory Investigation of Filters for Enid and Grenada Dams" and "Investigation of Wooden Well Screens for Grenada, Enid and Sardis Dams." These are available at $1 each from the Waterways Experiment Station, Vicksburg, Miss.

INDUSTRIAL AND CITY WASTES, a 53-page booklet, is Bulletin No. 22 of the Engineering Experiment Station at Oregon State College. Written by three faculty members headed by Prof. Fred Merryfield, the booklet is a discussion of special stream pollution studies made during the war years. Methods and results are given with about half the booklet containing statistical data. Copies may be obtained for 40c. from the Oregon State Engineering Experiment Station, Corvallis, Ore.

AN EXHAUSTIVE STUDY of the fine-grained alluvial deposits in the lower part of the Mississippi River valley and the effects of these deposits is summarized in two pamphlets just issued by the Mississippi River Commission. This study was authorized by the Chief of Engineers, U. S. Army, in 1944, and was carried out under the immediate direction of the staff of the Waterways Experiment Station at Vicksburg, with Harold N. Fisk, professor of geology, Louisiana State University, as consultant. Volume 1 of this report gives the findings, and Volume 2 is made up entirely of maps and numerous cross sections of the alluvial valley. Copies of the report, which is entitled "Fine-Grained Alluvial Deposits and Their Effects on Mississippi River Activity," can be obtained from the Waterways Experiment Station, Vicksburg, Miss. for $2.50 the set.

MUCH INFORMATION on concrete pavement design is packed into Technical Bulletin No. 121 of the American Road Builders Association (International Building, Washington 4, D. C.). Tables give the current soil and sub-grade practices of the state highway departments, also their specifications for aggregates, cement, also proportioning, mixing and finishing requirements, and the structural features of concrete pavement.

TWO NEW STANDARDS of interest to civil engineers have been adopted by the American Standards Association, 70 East 45th St., New York 17, N. Y., and are available at 50c. each. Building Code Requirements for Reinforced Concrete (ACI 318-47) (A89.1-1948) is a revision of A89.1–1946, with changes mainly of an editorial nature. Practice for Street and Highway Lighting (D12.1–1947) discusses lighting relative to current night traffic problems, the classification of traffic arteries, luminaires characteristics and applications.

LIGHT PORTABLE BRIDGE EQUIPMENT developed for German army mountain troops is described in a report now on sale by the Office of Technical Services. Much of the report is devoted to "G-bridge" equipment used by the Germans in many types of bridging operations, suspension bridges in particular. It is of special interest because the U. S. Army had no counterpart. Also included in this 376-page report is a description of light pier bridging equipment. Entitled PB-85190, "German Mountain Engineer Equipment," mimeograph copies sell for $9.50. Orders should be addressed to Office of Technical Services, Department of Commerce, Washington 25, D. C. Make checks payable to the Treasurer of the U. S.

New Engineering Books

SUBSTRUCTURE ANALYSIS AND DESIGN—By Paul Andersen. 305 pp. Irwin-Farnham Publishing Co., Chicago. $4.50.

REINFORCED CONCRETE DESIGNER'S HANDBOOK—Fourth Edition—By Chas E. Reynolds. 351 pp. Concrete Publications Ltd., London. 15s. Obtainable through Stechart & Hafner, 31 East 10th St., New York 3.

ZONING IN NEW YORK—By Latham C. Squire. 95 pp. Home Title Guaranty Co., New York. $4.

PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS—Vol. V, Number 2. 153 pp. Addison-Wesley Press, Cambridge 42, Mass. $6.

AN INTRODUCTION TO COLOR—By Ralph M. Evans. 327 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $6.

THE NEW INTERNATIONAL YEAR BOOK, A COMPENDIUM OF THE WORLD'S PROGRESS FOR THE YEAR 1947—Edited by Henry E. Vizetelly. 683 pp. Funk & Wagnalls Co., New York. $10.

PRACTICAL ASTRONOMY—Fourth Edition—By the late George L. Hosmer, Revised by James M. Robbins. 355 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $4.50.

PRACTICAL ASTRONOMY—Second Edition—By Jason John Nassau. 311 pp. McGraw-Hill Book Co., New York and London. $5.

(*Continued on page* 139)

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CHOOSE . . . as others have — THE MODEL THAT BEST FITS YOUR NEEDS!

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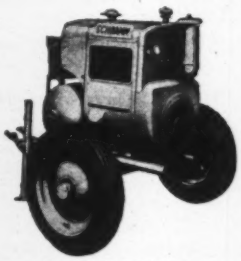
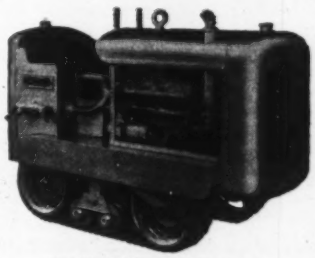
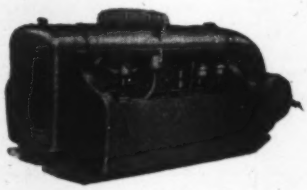


20/35 Model Compressor

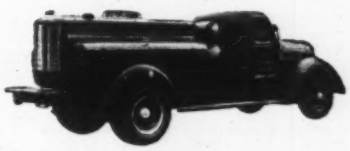


No. 60 Self-Propelled Compressor

Two-Wheel Trailer Mounting with Tool Boxes

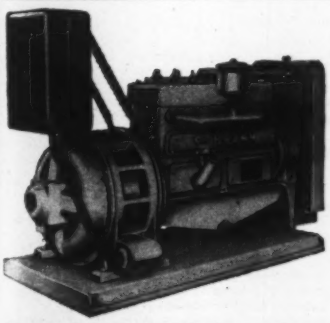


Skidded for Truck Mounting

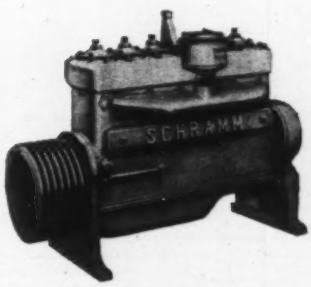


Truck Mounted

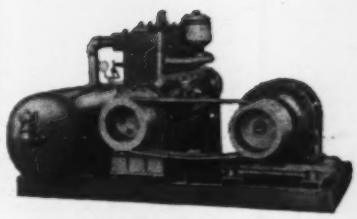
Diesel Engine Drive



Built-in Motor Drive with Cooling Unit and Starter



"V" Belt on Flat Pulley Drive



"V" Belt Drive with Air Receiver

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
September Materials and Labor Prices will appear in the September 16, 1948 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash, dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK CONCRETE 8x8x16-in.; truckload del.; per block		Ready Mixed 1:2:4 over
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	50 ¢ yde
Atlanta	$4.11	$3.34	$3.05	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	4.12	3.35	3.06	2.20*fft*	2.20*fft*	1.80*fft*	2.40*fft*	2.50*fft*	2.35*fft*	2.35*fft*	.15	.15*w*	9.20
Birmingham	3.65	2.88	....	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.71	3.94	3.65	2.50*t*	2.50*t*	2.50*t*	1.50*t*	1.60*t*	....	....	.16	.185*w*	10.50*u*
Chicago	4.05§	3.28§	3.00§	2.75‡*d*	2.75‡*d*	3.20‡*d*	2.75‡*d*	2.75‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.90	3.13	2.85	1.85‡*pp*	1.85‡*pp*	1.75‡*pp*	2.95‡*bb*	2.95‡*bb*	2.20	2.20	.19	.195	10.05*kk*
Cleveland	3.87	3.10	2.77	1.90*lli*	1.65*llj*	1.55*ll*	3.45‡*h*	3.45‡*h*	2.60	2.60	....	.21	11.20*ss*
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.10	2.15	....	....	.0775*p*	.255	8.85
Denver	....	3.59	3.29	1.85	2.00	1.15	....	....	....	....	.21	.2175*w*	9.65
Detroit	3.92	3.15	2.87	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17	.18*w*	10.60*kk*
Kansas City	....	....	....	2.05	2.05	1.50/1.80*t*	1.45*q*	1.45*q*	....	....	.16*wf*	.175*ay*	9.85*n*
Los Angeles	....	3.70*b*	3.20*b*	1.92‡	2.02‡	1.72*tnn*	1.92‡	1.92‡	....	....	.085*oo*	....	9.96*m*
Minneapolis	4.05*dd*	3.28*dd*	3.00*dd*	2.10*h*‡*j*	2.10*h*‡*j*	1.20*h*‡*j*	2.20*h*‡*j*	2.20*h*‡*j*	....	....	.21*cco*	....	10.30*jii*
Montreal	....	2.39*rqq*	2.24*rqq*	....	1.95*bbs*	....	1.55*cs*	1.75*cs*	....	....	.22	.2265*w*	8.95*ls*
New Orleans	....	2.88	2.60	2.32	2.32	1.82	....	....	.90	1.15	.23	....	10.65
New York	....	4.20‡	....	2.00*de*	2.00*de*	1.45*de*	2.00*dv*	2.00*dv*	....	....	.18*ii*	.18*wcciii*	10.50*k*
Philadelphia	4.01‡	3.24‡	2.96‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.22/.25	.22/.25*w*	9.85
Pittsburgh	3.79	3.02	2.74	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22*z*	.22*z*	11.00
St. Louis	3.80*o*	3.03*o*	2.75*o*	2.40‡*oh*	2.40‡*oh*	2.00/2.40‡*oh*	1.50*c*	1.50*c*	1.10	1.15	.20	.23*yo*	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	....	....	....	....	.25*y*	10.75*u*
Seattle	.....	3.45*mm*	2.95*mm*	2.75‡*od*	2.75‡*od*	2.75‡*od*	3.50‡*od*	3.50‡*od*	....	....	.22*o*	....	9.75*o*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ¾ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand. *oo* 4x8x12 std. wgt. *pp* 5 tons or more. *qq* Dealer's commission not included. * Prices include dealer's commission except where indicated to the contrary. § Maximum prices. Sales at lower levels.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES AT CEMENT MILLS

Charge for bags not included. For cloth bags, add $1.05 per bbl.;25¢ refund allowed for each returnable bag; for paper bags add 28¢ per bbl., not refundable.

	Bagged		Bagged		Bagged		Bagged		Bagged
Richard City, Tenn.	$2.25	Independence, Kan.	$2.20	Duluth, Minn.	$2.30/2.40	Harrys, Tex.	$2.15	Wyandotte, Mich.	$2.25
Clinchfield, Ga.	2.25	Hannibal, Mo.	2.20	Hudson, N. Y.	2.25/2.30	Manchester Switch, Tex.	2.25	Buffalo, N. Y.	2.35
Kingsport, Tenn.	2.25	Northampton, Pa.	2.30	North Birmingham, Ala.	2.10	South Norfolk, Va.	2.45	Oswego, N. Y.	2.40
West Des Moines, Iowa	2.30	Universal, Pa.	2.20	Spocari, Ala.	2.20	Alpena, Mich.	2.20	Cleveland, O.	2.35
Nazareth, Pa.	2.25/2.30	Waco, Tex.	1.95	Limedale, Ind.	2.20	Detroit, Mich.	2.35	Toledo, O.	2.35
Bath, Pa.	2.30	Steelton, Minn.	2.30	Bonner Springs, Kan.	2.30	Muskegon, Mich.	2.35	Milwaukee, Wis.	2.35
Buffington, Ind.	2.20	Leeds, Ala.	2.10	New Orleams, La.	2.35	Saginaw, Mich.	2.35	Ironton, O.	2.35

Montreal City (Discount 10¢ per bbl. 20 days), $2.08.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8¼ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore	150.00‡	52.70‡	.....	$23.00	.....	$.095	$0.15	$.095*h*	$.17*h*	$.095*v*	$.095	$0.115
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	.....	.....	.....	23.00*o*	$34.00*o*	.0936*o*	.175*o*	.095*ho*	.185*ho*	.095*o*	.103*o*	.195
Chicago	150.00‡*y*	85.00/88.00*e*‡	3.10/4.15*d*‡	22.50*b*	32.00*b*	21.50*bg*	31.00*bg*	.097/.105*h*	.....	.082/.0845*h*	.0925/.1025*b*	.14/.165
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	186.52	49.00*qq*	3.87*u*	30.00	40.00	29.50*g*	39.50*g*	.135*h*	.22*h*	.13	.20	.27
Dallas	*l*	40.00	*l*	23.38	42.17	.0987	.1837	26.15	46.65	.0962	.1037	....
Denver	.....	41.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00*z*	.....	27.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.152
Kansas City	.....	40.00*g*	.....	20.45*r*	.....	.....	.....	.081*hr*	.....	.071*r*	.....	.....
Los Angeles	*l*	.....	*l*	17.50*mf*	32.00*mfw*	17.50*gm*	32.00*mw*	18.50*m*	25.50*mw*	17.00*gm*	.075*ee*	.145*e*
Minneapolis	.....	.....	2.79*d*	28.00	37.00	23.00*g*	34.00*g*	27.00	38.00	.105	.13	.23
Montreal	140.00	.....	.....	25.00*k*	34.65*k*	15.70*kp*	19.95*kp*	15.30*kp*	17.30*kp*	14.20*kj*	.174*k*	.219
New Orleans	.....	.....	.....	20.00*a*	.....*s*	20.00*qa*	.....*s*	.095*hadd*	.....*s*	.095	.0975	.16*s*
New York	.....	.....	2.50*d*	26.50	38.86	25.50*g*	44.88*g*	.1090*h*	.1917*h*	.1040	.1090	.188
Philadelphia	150.00	62.00	4.06	23.00	.....	22.00*g*	.....	.095*h*	.....	.....	.....	.....
Pittsburgh	165.00	42.00	4.50	26.00	39.00	.12	.24	27.00	42.00	.095	.10	.21
St. Louis	.....	.....	.....	21.40	.....	.....	.....	.....	.....	.....	.1025	.....
San Francisco	.....	57.75*c*	.....	17.50*ee*	32.00*wee*	17.50*peff*	.....	19.50*ee*	.....	.....	.0725	.142
Seattle	.....	.....	.....	16.50*i*	33.00*i*	15.00*ig*	.....	18.00*i*	22.00*aai*	16.00*ij*	.0675*i*	.082

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–80 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. *n* 55 gal. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. Buffalo. F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *u* 3-in. *v* Bulk, refinery. *w* Shipped in steel barrels no longer in double head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *aa* In customer's drums. *cc* F.o.b. refinery, Inglewood. *dd* Medium curing. Rapid curing, $.0975; slow curing, $.0925. *ee* F.o.b. Richmond. *ff* 50–300 penetration. *gg* May-June price of $52 was for 4 x 5½ x 8½.

IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT. SHAPES– PLATE	REINF. BARS‖ billet *be*	RIVETS‖ ½-in. structural	WIRE NAILS Base	SHEET PILING‖ Base	STEEL RAILS‖ Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES‖ Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
ningham	$3.25	$2.70	$5.65	..	....	$54.00/55.00	$61.00	Not	$3.75/3.85	$4.85	$3.55/3.65	$7.00
cago	3.25	2.70	5.65	....	$3.30	.....	.....	avail-	3.75/3.85	4.85	3.55/3.65	7.00
aburgh	3.25	2.70/2.75	5.65	...	3.30	$54.00/55.00	61.00	able	3.75/3.85	4.85	3.55/3.65	7.00
falo	....	2.75	....	....	3.30	.....	.....	....	....	....	3.55/3.65	....
eland	....	....	5.65	...	....	.....	.....	....	....	....	....	....
ngstown	....	2.70	....	....	....	.....	.....	....	....	4.85	....	....
y	3.25	2.70	....	....	....	.....	.....	....	....	....	....	....
evs	....	....	....	....	....	.....	.....	....	....	....	....	....
Angeles	3.424/3.474‡*§ 3.329‡	....	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, Lebanon, Pa., Richmond, Va. *e* Mill lengths. Add 50¢ for cut lengths. * 3.343 for sizes produced at Geneva. § **July 21 increase not shown in these prices.**

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

July 21 increase not shown in these prices	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING‖ Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price
nta	$4.75*	$5.225‡	$5.225‡	$.025	$.10	$31.50	$33.50				....
timore	4.68	4.03*l*	....	....	.10	33.50	35.50				..
ningham	4.25	4.40	4.40	.05	.15	43.00*p*	45.50*p*				....
ton	5.14‡	4.70‡	4.08‡*c*	....	.10/.15	28.00	30.00				$3.84*k*
ago	4.35	3.50*ff*	3.50*ff*	.05	.05	28.00‡	30.00‡				3.30*a*
cinnati	4.80‡	3.883*c*	3.883*c*	....	....	30.00*zee*	32.00*zee*				3.708*d*
eland	4.72	3.62*s*	....	....	.10	31.50	33.50				....
is	6.30	6.25	6.25	....	....	33.75	35.75				....
ver	5.95	5.80*c*	....	....	....	40.00*s*	45.50*qs*				5.89
roit	4.80‡	....	....	....	.10	33.50*x*	35.50*q*				3.712*yee*
sas City	5.35*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00				3.918*s*
Angeles	5.10*ffhh*	5.10	....	....	....	41.00*fk*	....				4.64*djj*
neapolis	4.82‡	5.38*ccn*	5.38*ccn*	...	.15	31.50*k*	33.50*k*				3.89*k*
treal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*				78.70*jdqq*
Orleans	....	4.73*ok*	....	.05	.10	32.00	32.00				.....
York	4.82*r*	5.50§	....	....	.15/.20	31.00*st*	33.00*st*				3.30*i*
adelphia	4.59	4.65	....	....	....	30.00‡	32.00‡				3.80
burgh	4.40/4.50	4.40/4.50	4.40/4.50	.05	.10	32.50	34.50				....
Louis	4.74‡	4.49*c*	4.49*c*	....	....	40.00‡	42.00‡				....
Francisco	5.00*ii*	4.58	....	....	....	33.50	35.50				4.85
tle	3.777*s*	4.43*el*	....	....	....	35.00*w*	38.50*w*				4.576*ddl*

Joliet, Illinois, Donora, Penn., $2.12 Monessen, Penn., $2.36 — Joliet, Illinois, Donora, Penn., $1.49 Monessen, Penn., $1.64 — Joliet, Illinois, Donora, Penn., $2.23 Monessen, Penn., $2.48 — F.o.b. Mill:

‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plan cludes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax npt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and l grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons ver. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢, ¾ in., ⅝ in. 15¢, ½ in. 20¢, ⅜ in. 35¢, ¼ in. 55¢, ¼ in. $1.30. *v* Under ons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Including sales tax. *hh* $4.95 if rolled at Geneva, Utah mills. *ii* Rolled at eva mill. *jj* From Chic. From Pitts., $4.81. * Comparable delivery price is $5.225. § Includes July 21 price increase.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

y 21 steel price ncrease not ected in these prices	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13–44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4–24 Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTMC 14–41 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *s*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
nta	$92.10	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	48.2	32.2	42.2	25.7
timore	96.50	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	51.9	35.9	45.9	29.4
ningham	85.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	48.2	32.2	42.2	25.7
ton	99.90	.441*uvz*	.8505*uvz*	$3.487*uvy*	10.36*uvy*	173.40	267.60	...	....	50.2	34.2	44.2	27.7
ago	98.70	.59	1.14	4.81	13.45	150.00‡	270.00‡	.65	2.25	54.0*t*	38.0*t*	47.0*t*	30.5
cinnati	97.20	.441	.8505	3.51	9.53	154.80‡	241.20‡	.60	2.25	52.4	36.4	46.4	29.9*t*
eland	99.30	.35*x*	.675*x*	2.97*x*	9.3025*x*	141.50	221.00	.65	2.50	54.7	38.7	48.7	32.2
is	101.08	.365	.684	2.72	6.25	109.00	131.00	.48	1.55	46.3	30.3	40.3	23.8
ver	105.92	.41*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*	44.4	28.4	38.2	21.7
roit	99.30	....	.....	.....	....	195.00‡*m*	303.00‡*m*	.55	2.20	52.9	36.9	46.9	30.4
sas City	100.42	.39*m*	.705*m*	2.78*m*	7.15*m*	175.00*m*	310.00*m*	.60*l*	1.90*l*	49.7	33.7	43.3	26.8
Angeles	112.30	.428	.920	4.461	10.167	195.88‡	323.70‡	.65	...	....	....	....	....
neapolis	100.40	.62*mo*	1.12*mo*	4.35*mo*	....	.....	.....	1.19*hh*	3.18*hh*	49.8	33.8	43.4	26.9
treal	78.20	.73*s*	1.28*s*	4.20*s*	6.80*es*	.60*paa*	.48*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
Orleans	95.10	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95	47.8	31.8	41.8	25.3
York	95.50	.62	1.14	4.45	12.30	.....	.....	1.00	2.25	51.2	35.2	45.2	28.7
adelphia	93.30	.54	.99	4.08	10.25	235.00‡	300.00‡	1.25*h*	3.20*h*	51.7	35.7	45.7	29.2
burgh	99.82	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*	55.0*t*	38.0*t*	49.0*t*	32.5
ouis	96.60	.46	.83	3.31	7.85	.....	.....	1.10*il*	2.30*hl*	51.6	35.6	44.7	28.2
Francisco	112.30	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	282.00*dl*	.69	2.85	....	....	....	....
le	114.10	.51*b*	.91*b*	....	....	150.00*cc*	.....	.80	2.40	....	....	....	....

Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, (base) $90.50. Based on existing freight rates; subject to rate change. ipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. larger, usually $1 per ton less. *b* Extra strength ASTM C 200–44T. ., $90. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM 41. *h* Reinforced. ASTM C75–41. *i* Reinforced. ASTM C76–37. ntrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. counts from standard list consumers carload prices. Base price approx. per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; ., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13–40. *v* F.o.b. city *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60–1941 specifications used. *aa* No. standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck **20% emergency freight rate increment granted railroads on Jan. 5 and May 6 freight rate increase (10% in East; 5% on average for U. S.) not included.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 4. galv. +16.5; 1½ in. black, 9.5, galv. +13; 2 in. black 10, galv. +12.5. Lap weld — 2½ in. to 3½ in. black 4, galv. +16; 4½ in. to 8 in. black 6, galv. +12. Freight rates to destination to be added to name delivered price.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
September Materials and Labor Prices will appear in the September 16, 1948 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash, dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block	CONCRETE Ready-Mixed 1:2:4 mix, over 5 sacks per cu. yd.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	50 cu. yds.
Atlanta	$4.11	$3.34	$3.05	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	4.12	3.35	3.06	2.20*ff*	2.20*ff*	1.80*ff*	2.40*ff*	2.50*ff*	2.35*ff*	2.35*ff*	.15	.15*w*	9.20
Birmingham	3.65	2.88	....	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.71	3.94	3.65	2.50*t*	2.50*t*	2.50*t*	1.50*t*	1.60*t*	....	....	.16	.185*w*	10.50*u*
Chicago	4.05§	3.28§	3.00§	2.75‡*d*	2.75‡*d*	3.20‡*d*	2.75‡*d*	2.75‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.90	3.13	2.85	1.85‡*pp*	1.85‡*pp*	1.75‡*pp*	2.95‡*bb*	2.95‡*bb*	2.20	2.20	.19	.195	10.05*hh*
Cleveland	3.87	3.10	2.77	1.90*llg*	1.65*llg*	1.55*ll*	3.45‡*h*	3.45‡*h*	2.60	2.60	....	.21	11.20*aa*
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.10	2.15	....	....	.0775*p*	.255	8.85
Denver	.....	3.59	3.29	1.85	2.00	1.15	....	....	....	....	.21	.2175*w*	9.65
Detroit	3.92	3.15	2.87	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17	.18*w*	10.60*kk*
Kansas City	....	....	....	2.05	2.05	1.50/1.80*t*	1.45*q*	1.45*q*	....	....	.16*wf*	.175*ay*	9.85*n*
Los Angeles	....	3.70*b*	3.20*b*	1.92*t*	2.02*t*	1.72*nn*	1.92*t*	1.92*t*	....	....	.085*oo*	....	9.96*m*
Minneapolis	4.05*dd*	3.28*dd*	3.00*dd*	2.10*h*‡*j*	2.10*h*‡*j*	1.20*h*‡*j*	2.20*h*‡*j*	2.20*h*‡*j*	....	....	.21*cco*	....	10.30*jj*
Montreal	....	2.39*rqq*	2.24*rqq*	....	1.95*bbs*	....	1.55*cs*	1.75*cs*	....	....	.22	.2265*w*	8.95*ss*
New Orleans	....	2.88	2.60	2.32	2.32	1.82	....	....	.90	1.15	.23	....	10.65
New York	....	4.20‡	....	2.00*de*	2.00*de*	1.45*de*	2.00*dv*	2.00*dv*	....	....	.18*ii*	.18*wcc*‡*ii*	10.50*k*
Philadelphia	4.01‡	3.24‡	2.96‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.22/.25	.22/.25*w*	9.85
Pittsburgh	3.79	3.02	2.74	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22*z*	.22*z*	11.00
St. Louis	3.80*o*	3.03*o*	2.75*o*	2.40‡*oh*	2.40‡*oh*	2.00/2.40‡*oh*	1.50*c*	1.50*c*	1.10	1.15	.20	.23*yo*	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	....	....	....	....	.25*y*	10.75*u*
Seattle	.....	3.45*mm*	2.95*mm*	2.75‡*od*	2.75‡*od*	2.75‡*od*	3.50‡*od*	3.50‡*od*	....	....	.22*o*	....	9.75*o*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Havdite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand. *oo* 4x8x12 std. wgt. *pp* 5 tons or more. *qq* Dealer's commission not included. * Prices include dealer's commission except where indicated to the contrary. § Maximum prices. Sales at lower levels.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES AT CEMENT MILLS

Charge for bags not included. For cloth bags, add $1.05 per bbl.;25¢ refund allowed for each returnable bag; for paper bags add 28¢ per bbl., not refundable.

	Bagged		Bagged		Bagged		Bagged		Bagged
Richard City, Tenn.	$2.25	Independence, Kan.	$2.20	Duluth, Minn.	$2.30/2.40	Harrys, Tex.	$2.15	Wyandotte, Mich.	$2.25
Clinchfield, Ga.	2.25	Hannibal, Mo.	2.20	Hudson, N. Y.	2.25/2.30	Manchester Switch, Tex.	2.25	Buffalo, N. Y.	2.35
Kingsport, Tenn.	2.25	Northampton, Pa.	2.30	North Birmingham, Ala.	2.10	South Norfolk, Va.	2.45	Oswego, N. Y.	2.40
West Des Moines, Iowa	2.30	Universal, Pa.	2.20	Spocari, Ala.	2.20	Alpena, Mich.	2.20	Cleveland, O.	2.35
Nazareth, Pa.	2.25/2.30	Waco, Tex.	1.95	Limedale, Ind.	2.20	Detroit, Mich.	2.35	Toledo, O.	2.35
Bath, Pa.	2.30	Steelton, Minn.	2.30	Bonner Springs, Kan.	2.30	Muskegon, Mich.	2.35	Milwaukee, Wis.	2.35
Buffington, Ind.	2.20	Leeds, Ala.	2.10	New Orleans, La.	2.35	Saginaw, Mich.	2.35	Ironton, O.	2.40

Montreal City (Discount 10¢ per bbl. 20 days), $2.08.

PAVING BRICK, BLOCK,

	PAVING BRICK AND BLOCK			PAVING ASPH
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Per ton, less tha penetration Tank car
Atlanta	$73.00	$35.00	$2.25	.....
Baltimore	180.00‡	52.70‡	.....	$23.00
Birmingham	.....	32.00	.....	.....
Boston	.....	.....	.....	23.00*e*
Chicago	150.00‡*y*	85.00/88.00*e*‡	3.10/4.15*d*‡	22.50*b*
Cincinnati	.....	.....	.....	.....
Cleveland	186.52	49.00*gg*	3.87*u*	30.00
Dallas	*l*	40.00	*l*	23.38
Denver	.....	41.00	.....	.....
Detroit	.....	63.00*x*	.....	27.00
Kansas City	.....	40.00*q*	.....	20.45*e*
Los Angeles	*l*	.....	*l*	17.50*mm*
Minneapolis	.....	.....	2.79*d*	28.00
Montreal	140.00	.....	.....	25.00*k*
New Orleans	.....	.....	.....	20.00*e*
New York	.....	.....	2.50*d*	26.50
Philadelphia	150.00	62.00	4.06	23.00
Pittsburgh	165.00	42.00	4.50	26.00
St. Louis	.....	.....	.....	21.40
San Francisco	.....	57.75*e*	.....	17.50*ee*
Seattle	.....	.....	.....	16.50*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2½ x 8½ *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–60 pen *g* Per ton. *h* Per gallon. *i* F.o.b. Martines. *j* Shipped in drums, p *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliv

IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT. SHAPES–PLATE	REINF. BARS‡ billet *be*	RIVETS‡ ½-in. structural	WIRE NAILS Base	SHEET PILING‡ Base	STEEL RAILS‡ Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES‡ Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
ningham	$3.25	$2.70	$5.65	..	....	$54.00/55.00	$61.00	Not	$3.75/3.85	$4.85	$3.55/3.65	$7.00
ago	3.25	2.70	5.65	....	$3.30	....	....	avail-	3.75/3.85	4.85	3.55/3.65	7.00
sburgh	3.25	2.70/2.75	5.65	...	3.30	$54.00/55.00	61.00	able	3.75/3.85	4.85	3.55/3.65	7.00
alo	....	2.75	....	....	3.30	.....	.....	....	....	....	3.55/3.65	....
eland	....	....	5.65	...	....	.....	.....	....	....	....	....	....
ngstown	....	2.70	....	....	....	.....	.....	....	....	4.85	....	....
y	3.25	2.70	....	....	....	.....	.....	....	....	....	....	....
eva	....	....	....	....	....	.....	.....	....	....	....	....	....
Angeles	3.424/3.474‡*§	3.329‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Lebanon, Pa., Richmond, Va. *e* Mill lengths. Add 50¢ for cut lengths. Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, * 3.343 for sizes produced at Geneva. § July 21 increase not shown in these prices.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

July 21 increase not shown in these prices	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING§ Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price
nta	$4.75*	$5.225‡	$5.225‡	$.025	$.10	$31.50	$33.50				....
timore	4.68	4.03*l*	....	....	.10	33.50	35.50				..
ningham	4.25	4.40	4.40	.05	.15	43.00*p*	45.50*p*				....
ton	5.14‡	4.70‡	4.08‡*c*	....	.10/.15	28.00	30.00				$3.84*k*
ago	4.35	3.50*ff*	3.50*ff*	.05	.05	28.00‡	30.00‡				3.30*a*
cinnati	4.80‡	3.883*c*	3.883*c*	....	....	30.00*see*	32.00*see*				3.708*d*
eland	4.72	3.62*v*	....	....	.10	31.50	33.50				....
is	6.30	6.25	6.25	....	....	33.75	35.75				....
ver	5.95	5.80*c*	....	....	....	40.00*s*	45.50*qs*				5.80
roit	4.80‡	....	....	....	.10	33.50*x*	35.50*q*				3.712*yee*
sas City	5.35*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00				3.918*e*
Angeles	5.10*fhh*	5.10	....	....	....	41.00/*k*	....				4.64*djj*
neapolis	4.82‡	5.38*con*	5.38*con*	...	.15	31.50*k*	33.50*k*				3.89*k*
treal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*				78.70*jdoo*
Orleans	....	4.73*ok*	....	.05	.10	32.00	32.00				.....
York	4.82*r*	5.50§	....	....	.15/.20	31.00*st*	33.00*st*				3.30*t*
adelphia	4.59	4.65	....	....	....	30.00‡	32.00‡				3.80
sburgh	4.40/4.50	4.40/4.50	4.40/4.50	.05	.10	32.50	34.50				....
Louis	4.74‡	4.49*c*	4.49*c*	....	....	40.00‡	42.00‡				....
Francisco	5.00*ii*	4.58	....	....	....	33.50	35.50				4.85
tle	3.777*s*	4.43*el*	....	....	....	35.00*w*	38.50*w*				4.576*dd*

Joliet, Illinois, Donora, Penn., $2.12 — Moneesn, Penn., $2.36 (F.o.b. Mill)

Joliet, Illinois, Donora, Penn., $1.49 — Moneesn, Penn., $1.64 (F.o.b. Mill)

Joliet, Illinois, Donora, Penn., $2.23 — Moneesn, Penn., $2.48 (F.o.b. Mill)

‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plan cludes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax npt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and l grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons ver. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢, ¾ in., ⅞ in. 15¢, ⅞ in. 20¢, ½ in. 35¢, ⅝ in. 55¢, ¾ in. $1.30. *v* Under ons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Including sales tax. *hh* $4.95 if rolled at Geneva, Utah mills. *ii* Rolled at mill. *jj* From Chic. From Pitts., $4.81. * Comparable delivery price is $5.225. § Includes July 21 price increase.

DRAIN PIPE

WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *s*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
48.2	32.2	42.2	25.7
51.9	35.9	45.9	29.4
48.2	32.2	42.2	25.7
50.2	34.2	44.2	27.7
54.0*t*	38.0*t*	47.0*t*	30.5
52.4	36.4	46.4	29.9*t*
54.7	38.7	48.7	32.2
46.3	30.3	40.3	23.8
44.4	28.4	38.2	21.7
52.9	36.9	46.9	30.4
49.7	33.7	43.3	26.8
....	....	....	....
49.8	33.8	43.4	26.9
....	....	....	....
47.8	31.8	41.8	25.3
51.2	35.2	45.2	28.7
51.7	35.7	45.7	29.2
55.0*t*	38.0*t*	49.0*t*	32.5
51.6	35.6	44.7	28.2
....	....	....	....
....	....	....	....

vitching limits. *u* ASTM C13–40. *v* F.o.b. city *z* CESA A60–1941 specifications used. *aa* No. *bb* Freight allowed to destinations in city. Newton. *dd* LCL, delivered, f.o.b. truck ncrement granted railroads on Jan. 5 and May 6 East; 5% on average for U. S.) not included. List prices per ft. same as wrought steel pipe. Butt weld — 1 in. and 1¼ in. black, 4, galv. +13; 2 in. black 10, galv. +12.5. Lap weld — +16; 4½ in. to 8 in. black 6, galv. +12. Freight to name delivered price.

HTLY

UND

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight (See note for
	1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	¾"
Atlanta	l **$70.00**	**$71.00**	**$60.00**	**$62.00**	**$65.00**	**$68.00**	**$70.00**	.....	.....	.....	.....	**$22.32**
Baltimore	**90.00**	**95.00**	**92.00**	**95.00**	**95.00**	**98.00**	**115.00**	.....	.....	175.00	175.00	22.86
	120.00	*120.00*	*115.00*	*115.00*	*115.00*	*115.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....
Birmingham	l **90.50**	**90.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....	120.00	117.50	21.78
	l *95.50*	*95.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*108.00*	*108.00*	.....	...	.....
Boston	**80.00**[a]	**80.85**[a]	**85.00**[a]	**85.00**[a]	**85.00**[a]	**90.00**[a]	**100.00**[a]	.....	.....	.....	.....	**22.86**
	100.00	*100.00*	*102.00*	*85.00*	*85.00*	*105.00*	*105.00*	*105.00*	*105.00*	105.00	105.00	.....
Chicago	‡ **90.00**	**95.00**	**80.00**	**85.00**	**87.00**	**93.00**	**100.00**	.....	.....	120.00	120.00	18.72
	‡ *108.00*	*108.00*	*100.00*	*100.00*	*100.00*	*106.00*	*105.00*	*105.00*	*105.00*	.....	.....	.....
Cincinnati	**102.00**	**104.00**	**104.00**	**100.00**	**102.00**	**115.00**	.....	.....	.....	145.00	.....	21.78
Cleveland	**92/95**	**92/95**	**82/89**	**82/89**	**82/89**	**87/94**	.....	.....	.....	.....	.....	22.20
Dallas	l **71.00**	**71.00**	**61.00**	**59.00**	**61.00**	**66.00**	**80.00**	.....	.....	**72.00**	**80.00**	18.72
Denver	*96.00*	*96.00*	*101.00*	*97.50*	*97.50*	*98.50*	*109.00*	*117.50*	*116.50*	.....	.....	13.92
Detroit	**85.00**	**87.00**	**85.00**	**85.00**	**87.00**	**91.00**	.....	.....	.....	.....	.....	21.78
	84.00	*94.00*	*94.00*	*94.00*	*94.00*	.....	.....	.....	.....	.....	.....	.....
Kansas City	b **110.00**	**110.00**	**100/103**	**100/103**	**105.00**	**105.00**	.....	.....	.....	105.00	105.00	16.56
	b *115.00*	*115.00*	*105/108*	*105/108*	*110.00*	*110.00*	*120/125*	*135.00*	*135.00*	.....	.. ..	.....
Los Angeles	a *104.00*	*104.00*	*103.00*	*103.00*	*103.00*	*103.00*	*111.00*	*120.00*	*110.00*	.....	.....	13.38g/h
Minneapolis	‡b 117.00[a]	117.00[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....	16.56
	‡b *108.00*	*108.00*	*108.00*	*108.00*	*108.00*	*110.00*	*130.00*	*130.00*	*130.00*	.....	.....	.....
Montreal	e[d] 73.00	76.00	70.00	72.00	76.00	85.00	.....	.....	...	.....	.....	.....
	111.55	*111.55*	*111.55*	*111.55*	*111.55*	*111.55*	.....	.....	.....	.....	.....	.....
New Orleans	l **80.00**	**90.00**	**75.00**	**80.00**	**80.00**	**77.00**	**85.00**	.....	.....	100.00	105.00	18.72
	l *68.00*	*68.00*	*70.00*	*67.00*	*67.00*	*67.00*	*71.00*	*67.00*	*72.00*	.....	.....	.....
New York	‡ **95/100**	**95/100**	**Range from $90.00 to $95.00**				**110/115**			175/200†	175/200†	22.86
	‡	.....	*Range from $110.00 to $115.00*				*110/115*	*120/125*	*120/125*	.....	.....	.....
Philadelphia			**Range from $100.00 to $110.00**				**100/110**	.....	.....	180.00	180.00	22.86
			Range from $110.00 to $120.00				*110/120*	*127.00*	*127.00*	.....	.....	.....
Pittsburgh	l **78.00**	**79.00**	**82.00**	**84.10**	**89.25**	**93.70**	**112.00**	.....	.....	130.20	141.00	22.56
	l *103.60*	*103.60*	*105.00*	*105.00*	*109.00*	*129.75*	*132.00*	.....	.....	.....	.....	.....
St. Louis	‡j **95.00**	**99.50**	**89.50m**	**94.50m**	**101.50m**	**106.00m**	.....	.....	.....	.....	.....	18.72
	‡j	.....	*111.00n*	*116.00n*	*116.50n*	*116.50n*	.....	.....	.....	.....	.....	.....
San Francisco	d *81.00*	*81.00*	*81.00*	*81.00*	*81.00*	*79.00*	*79.00*	*79.00*	*79.00*	.....	.....	10.08g
Seattle	l *70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*75.00i*	*75.00i*	*75.00i*	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [a] Spruce. [b] Western Pine No. 3 Common. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Direct mill prices; f.o.b. purchasers carrier or truck. *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truck load in Greater Cleveland. Less 2% for cash. Truck lots. F.o.b. mill. *m* 8 to 12 ft. lengths. *n* 8 to 16 ft. lengths.

Note: Special concrete form grade Fir Plywood, 4′ by 8′ panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface Seattle base price on ⅜", $188.00; on ½", $218.00. For other centers add the freight increment from table on proper size. Oiling and edge sealing charge included.

[*] Freight rates include 20% emergency increase granted railroads on Jan. 1.

† 18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946a — Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots[*]	
	A quality	B quality		
Atlanta	76%	76%	$0.2025	
Baltimore	70–10%	71–10%	.2025	
Birmingham	68%	68%	.1575	
Boston	69%i	69%i	.2025	
Chicago	68%	68%	.2025	
Cincinnati	67–6%e	67–6%e	.2025	
Cleveland	67–10–10%	67–10–10–10%	.2425	
Dallas	65%	65%	.215	
Denver	68%	68%	.2075	
Detroit	67–10–10%	67–10–10%	.2025	
Kansas City	68–10%e	68–10%e	.2075	
Los Angeles	62%	67%f	.21	
Minneapolis	68%	68%	.2075	
Montreal	40–5%bc	40–10–5%bc	18.90h	
New Orleans	68%	68%	.2125	
New York	73%	74%	.32g	
Philadelphia	69%	70%	.2025	
Pittsburgh	70%	70%	.175	
St. Louis	70–10%	70–10%	.2075	
San Francisco	66%	73%	.2075	
Seattle	57%	58%	.21	

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

Glass: *a* Jobbers' list price per box, 14 x 20, ss, $20.75 for A quality, $18.00 for B quality; 14 x 20, ds, $30.75 for A quality, $26.00 for B quality. *b* Discount from list, Sept. 1939; sales tax included, but 6% tax exemption not allowable for. *c* Single thickness. *e* Discount from list of Aug. 15, 1938. *f* ss; ds—67%. *i* Double thickness 64%.

Explosives: [*] Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *g* In borough of Kings, Queens, and Richmond and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *h* F.o.b. city per 100 lb. forcite, 40%, 60%, $20.65.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.155	$0.1825	$0.2025
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.16 – .1675	.1875–.20	.2075–.22
Rocky Mtn. States	.16 – .1725	.1875–.20	.2075–.225
Pacific N. W. States	.1575–.17	.19 – .2025	.21 – .2225
Pacific S. W. States	.155 – .1625	.1875–.195	.2075–.2175

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight to Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.37	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.39	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.72
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.73
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.43	.80
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.47	.74
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.60	.77
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	...	.78
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.80

[*] Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6′x8″x8′ Untr.	6′x8″x8′ Tr.	7′x9″x8′6″ Untr.	7′x9″x8′6″ Tr.
Boston	Oak i	....	.....	.....	.....
	Pine i	....	.....	.....	.....
New York	S. L. Sap Pine	$1.65	$2.85	$2.00	$3.30
	Mixed Oak	1.80	3.05	2.50	3.90
Birmingham	Hardwood	1.00	1.60a	....	2.35
Chicago	Red Oak	....	2.50/2.55a	....	3.25/3.60
Los Angeles	Douglas Fir	1.86	3.25a	.....	.....
Philadelphia	Red Oak	2.33	3.13	3.10	4.25
St. Louis	White Oak	1.90	..	2.60	....
	Red Oak	1.80	2.45a	2.50	3.35
	Sap Pine or Cypress	2.30a	....	....	....
San Francisco	Douglas Fir	1.60e	2.80f	2.10b/f	3.80
Montreal	Birch or Maple	....h	....h	....h	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 7′ x 9′ x 8′. *c* Empty cell. *e* Green. *f* F.o.b. cars. *h* No constant price available. *i* Not available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$4
Chlorine cylinders, liquid, per lb. f.o.b. works	.07
Calcium chloride, 77-80%, flaked, 100-lb. paper bag, f.o.b. works, ton	2
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1
Soda ash, 58%, in paper bags, per 100 lb. dense	1
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1
Sulphate of copper, in bags, per 100 lb f.o.b. works	7

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over,			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over,			BRICK Per M. in quantity		LIME Per ton, In paper, Carload lot,		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$25.00	$25.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	31.00*k*	33.00*k*	30.00	18.00	.....
Birmingham	97.50	104.00	195.00	231.00*r*	.....	.....	20.00*ff*	22.50*gg*	24.67	18.10	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	.....
Chicago	115.00	122.50	230.00	.....	.....	.....	21.00	23.00	25.50	19.50	.....
Cincinnati	155.00*j*	165.00*j*	220.00*jdd*	.....	.....	.....	33.00*j*	33.00*j*	22.00*j*	20.25*j*	.....
Cleveland	113.50*cc*	120.00*cc*	225.50*cc*	.....	.....	.....	27.50	27.50	22.00	20.00	24.75*ee*
Dallas	.....	110.00	.....	.....	.....	.....	18.75	20.00	28.00	22.00	.....
Denver	.....	.....	.....	.....	.....	.....	30.00	30.00	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	.....	.....	.....	.....	.....	.....	30.00*cc*	31.50*cc*	30.00	28.00	28.00
Kansas City	112.00	120.00	.....	.....	.....	.....	16.00*o*	18.50*o*	36.00*p*	30.00*p*	30.00*p*
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	20.00§	.....	.....	36.00	35.00
Minneapolis	151.00*p*	174.00*p*	315.00*p*	174.00*ep*	.....	.....	30.00*ep*	.....	34.50*bbe*	25.50*bbe*	34.50*bbde*
Montreal	100.00*aq*	110.00*aq*	206.25*aq*	151.50*aqq*	.....	294.40*aq*	25.50	37.00	12.50*ub*	14.00*ub*	18.45*u*
New Orleans	160.00	160.00	300.00	.....	.....	.....	29.00	.....	38.00	26.00	.....
New York	112.20*h*	119.60*h*	164.50*h*	179.40*hn*	.....	.....	30.50	.....	34.40	26.80	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	27.00	30.00	29.75	17.50	24.50
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	38.00*y*	20.46	18.85	2.97*m*
St. Louis	119.00	130.00	235.00	235.00	320.00	.....	30.50*al*	28.50*al*	.75*aaap*	.55*aaap*	.85*aaspee*
San Francisco	124.00*a*	139.50*a*	186.00*dda*	139.50*ta*	.....	.....	27.50	.....	24.85	24.85	2.48*m*
Seattle	150.00*cc*	160.00*cc*	.....	160.00*ccw*	.....	.....	32.00	39.00	32.00*hhh*	32.00*hhh*	3.60*mhh*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *g* 5½ x 8 x 12. *h* F.o.b. trucks, job site N.Y.C. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed tile. *o* F.o.b. Buffalo. *p* Truck lots. *q* Provincial and Municipal tax extra. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *hh* LCL. § F.o.b. plant.

PAINT, ROOFING — F. O. B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl.	WHITE LEAD Per 100 lb. in 100 lb. cases	READY-MIXED PAINT Per gal., drums			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Dry *a*	In oil *w*	Graphite *b*	Aluminum *c*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$21.60	$29.875	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	21.35	29.50	2.25	3.50	2.75	2.75	3.30	3.30	.55	34.00
Birmingham	21.60	29.875	4.40	4.52	....	3.05	3.00	3.00	.48	42.00*ee*
Boston	21.35	29.50	....	....	....	....	....	....	....	34.00
Chicago	21.35	29.50	....	....	....	2.82‡*u*	2.87‡*o*	2.87‡*o*	35.00‡*bbv*	38.00‡
Cincinnati	21.35	29.50	....	....	....	2.39‡	2.50‡	2.50‡	.35*y*‡	40.00‡
Cleveland	21.35	29.50	3.00	3.00*a*	3.00	2.55	2.60*o*	2.50*o*	.36*y*	38.00
Dallas	21.35	29.50	....	4.05	....	3.50*q*	3.75*q*	4.35*q*	.30	45.00
Denver	21.35	30.00	2.88	4.38	2.63	3.17*o*	3.10*o*	.....	.41*ff*	48.00
Detroit	21.35	29.50	2.40	3.20	2.20	2.39	2.50	2.55	.50	33.00
Kansas City	21.35	29.625	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	31.00
Los Angeles	21.60	30.00	2.80	4.00	3.50	2.32	1.77*s*	*l*	.65	*l*
Minneapolis	21.35	29.125*m*	....	....	....	2.42*idd*	2.47*hidd*	2.47*hidd*	.42*idd*	35.00*rdd*
Montreal	.....	19.20	2.90*p*	4.20*p*	3.62*p*	3.14*t*	2.85*tf*	2.30*tf*	.68*t*	2.15*kt*
New York	21.35	29.50	3.45*y*	....	3.45*y*	2.28	2.30*o*	2.38*o*	.34*s*	33.00
Philadelphia	21.35	29.50	3.25	3.65	3.15	2.54	2.94	2.94	.37	26.00
Pittsburgh	21.35	29.50	2.00	2.40	1.90	3.00	3.10*o*	3.10*o*	.37	40.00
St. Louis	21.35	29.50	....	....	....	2.97	2.97	2.97	.48	36.00
San Francisco	21.60	29.75	1.80	2.75*n*	1.35	2.27*z*	3.30*aa*	....	.38*g*	.....
Seattle	21.60	30.00	2.95*m*	2.95*m*	....	3.25*mqcc*	3.35*hmcc*	....	.49*mcc*	46.75*jmcc*

‡ Delivered Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll. 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *u* Per 90 lb. square. *v* Per ton. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton. *cc* LCL. truck delivery. *dd* 2% cash discount. *ee* Asphalt, in 100 lb. package. *ff* 5-gal. drums.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Electrical Workers	Steam-fitters	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.25	$1.775	$2.00	$2.00	$2.00	$2.00	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.40	2.20/2.40	2.25	2.25	2.25	1.25	1.25
Birmingham	2.25	1.80	2.15	1.75/2.00	2.20	2.00	2.25	.95	1.05
Boston	2.50	2.10	2.40	2.25	2.50	2.30	2.30	1.55	1.55
Chicago	2.40	2.35	2.40	2.45	2.40	2.35	2.35	1.70	1.70
Cincinnati	2.50	2.20	2.35	2.25/2.50	2.375	2.375	2.35	1.46	1.46
Cleveland	2.375	2.325	2.375	2.25	2.375	2.375	2.375	1.725	1.40
Dallas	2.25	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95/1.50
Denver	2.25*b*	2.10	2.00*b*	2.15*b*	2.25	2.25	2.24	1.40	1.35
Detroit	2.50	2.20	2.40	2.40	2.50	2.40	2.40	1.575	1.575
Kansas City	2.50	2.05	2.20	2.05/2.275	2.50	2.15	2.125	1.475	1.40
Los Angeles	2.625	2.0375	2.1125	1.9875	2.25	2.40	2.25	1.4875	1.4875
Minneapolis	2.25	2.05	2.175	2.00	2.25	2.21	2.00	1.45	1.45
New Orleans	2.05	1.75	2.00	1.625/1.875	1.875	2.00	2.25	.90	.90
New York	3.20*b*	2.75*b*	3.00	3.00	3.20*a*	2.50*a*	2.75*b*	1.70	1.70
Philadelphia	2.75	2.25	2.65	2.50	2.50	2.375	2.50	1.25	1.25
Pittsburgh	3.00	2.50	2.25	2.40	2.50	2.25	2.50	1.30	1.30
St. Louis	2.50	2.20	2.425	2.55	2.50	2.25	2.25	1.50	1.75
San Francisco	2.8125	2.16	2.25	2.125	2.25	2.25	2.25	1.525	1.525
Seattle	2.365	2.065	2.265	2.20	2.365	2.265	2.50	1.665	1.70
Montreal*	1.40	1.25	1.30	1.20	1.40	1.35	1.11	.94	.88

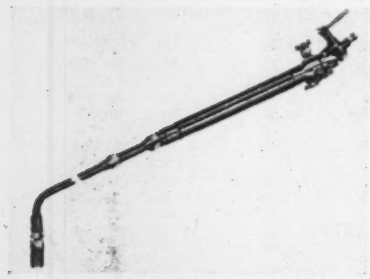
a 6 hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage.

MEXICO CITY PRICES

In Pesos, F.o.b. City		June '48	July '48
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3"-15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods			
⅜" x 12 meters	per ton	950.00	950.00
½" x 12 meters	per ton	950.00	900.00
⅝" x 12 meters	per ton	940.00	880.00
¾" x 12 meters	per ton	940.00	850.00
⅞" x 12 meters	per ton	930.00	850.00
1" x 12 meters	per ton	925.00	850.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	32.00	32.00
Rose Gravel	per tr. load	30.00	30.00
Cement, Std. Port. (Tolteca)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	375.00	375.00
1st Class Pine	per M ft.	750.00	750.00
2nd Class Pine	per M ft.	600.00	600.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) **$2.298. ENR Common Average: $1.386**

NEW PRODUCTS



WELDING AND HEATING TORCH—Three-hose torch using two tanks of acetylene and one of oxygen, is adapted to welding, heating or brazing broken parts on heavy machinery, for bending large diameter pipe and wherever rugged maintenance work is needed. Equipped with quick-operating oxygen cutoff and two-valve control for using propane, natural or manufactured gas and oxygen for heating purposes. Has sturdy brass handle and Monel tip-tube. Overall length is 51 in., weight 6 lb. 12 oz. Can be furnished for welding or with multiple-flame tips for heating.—*Weldit, Inc., 990 Oakman Boulevard, Detroit 6, Mich.*

WEATHER FORECASTING—Contractors can now obtain scientific aid in estimating the likelihood of favorable weather conditions. Instead of unwittingly taking a bigger chance than necessary, contractors can have the benefit of an expertly calculated probability curve for the kind of weather that concerns them. This is done by an empirical engineering method that interprets in terms of probabilities all currently known meteorological data for the region involved. Bids for construction work often are influenced by the likelihood of rain, wind, extreme cold, etc.; contractors speak of these risks as "a gamble" but by proper scientific approach, the probability of various types of weather can be calculated with scientific accuracy, according to officials.—*Stochastic Weather Service, 178 S. East Blvd., Corona, Calif.*

HEAVY-DUTY OIL, named Colonel Drake, fully detergent and dispersive and especially compounded for diesel and gasoline engines is refined from 100 percent Pennsylvania crude and is said to lengthen engine life and to reduce maintenance costs. Foaming is prevented by chemical additives. Sludge and soot particles are kept in constant suspension so that they drain off during oil changes. Other advantages claimed: eliminates ring sticking and bearing troubles; low pour point assures minimum drag and therefore easy starting; high viscosity index, assures less thinning out of the oil at high operating temperatures.—*Pennsylvania Refining Co., Butler, Pa.*

ILLUMINATED TALLY BOARD—"Tally-Lite" throws clear light on tally sheets for speeding checking and entering where there is little or no illumination. Sturdily built for hard usage, board has heavy filament three-volt bulb and uses three standard flashlight cells, assuring long battery life and easy replacement. Entire unit with batteries weighs only 24 ounces. Designed for anyone who is required to take records or inventories in bad light.—*Clyne Mfg. Co., 2619 Colerain Ave., Cincinnati 14, Ohio.*

ELECTRIC CABLE HOIST—(8-p. bulletin) Bob Cat line includes new 3 to 5-ton models featuring reduction in size by inclosing motor inside cable drum. The bulletin illustrates their gear train, employed in these models, by means of a cutaway view showing details of double internal (epicyclic) gear train employed instead of straight gear train commonly used. Standard lift is 20 ft. Capacities range from 2,000 to 10,000 lb.—*Lisbon Hoist and Crane Co., Lisbon, Ohio.*

COWHIDE WELDING GLOVES—New gloves of medium weight are chrome tanned cowhide, heavy enough to give protection, but light enough for flexibility, are a one-piece leather back employing a wing-type thumb construction and fabric lined cuff. Wing-type thumb allows maximum thumb action without binding or pulling across the palm. Exposed seams across back of glove have been eliminated to increase the "work life" of the glove. Suitable for use in either oxyacetylene or electric arc welding.—*Air Reduction Sales Co., 60 East 42 St., New York 17, N. Y.*

WIRE ROPE FOR SHOVELS—U. S. Steel subsidiaries feature American Tiger wire rope for shovels, draglines and other road-building equipment, wire fabric reinforcing for concrete slabs, steel for bridges and overpasses, and Atlas white cement for curbs and lane markers. Oil Well Supply Co. has 9-hp. diesel engine with electric starter and 10-kva. diesel electric plant.—*United States Steel Corp., Pittsburgh, Pa*

Manufacturers' Publications

Inside Metal Storm Window—(4-p. folder) Storm window combines with steel casement and screen to form a complete window unit. Made of formed steel bonderized, quickly and easily installed, and fits snugly against steel casement on inside. Reduces heat loss, provides greater comfort in cold weather, and minimizes condensation. Designed for use with Fenestra casements. Rubber gasket attached to storm window frame prevents metal-to-metal contact with casement, quickly sealing hole opening.—*Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit, Mich.*

Anniversary Booklet—The silver anniversary of the Peter F. Loftus Corp. is commemorated in a handsome brochure outlining the activities and accomplishments of Loftus in the field of consulting engineering. One of the outstanding projects described is the design and construction of the Lake Road generating station of the Department of Public Utilities of Cleveland, Ohio. Other sections in the brochure include the steel, aluminum, glass and food processing industries. In one case engineering work was consummated for the world's largest building under one roof. Many other projects are outlined, including design work for a supersonic wind tunnel laboratory for the U. S. government, and the design of the Loftus "packaged steam power plants," more than 300 of which have been exported to various parts of the world.—*Peter F. Loftus Corp., Oliver Bldg., Pittsburgh 22, Pa.*

Pipe Joint—Folder tells about Tylax, a rubber joint that is part of the pipe. It is a product of interest to users of concrete or ceramic pipe. When Type B Tylax joint is cast into the pipe it is set into a form which makes it perfectly round and of the proper size to receive the spigot. The casting material is then poured and serves not only to hold the gasket in the pipe properly but also fills in any spaces or irregularities present in the bell of the pipe when it was made.—*Hamilton Kent Manufacturing Co., Kent, Ohio.*

Building Panels—(4-p. folder). Fenestra building panels of 16-gage metal come in 16-in. widths, standard joists lengths. They combine joist, bridging, and sub-flooring. Panels provide flat top surface ready to receive floor finish. Cellular box provides space for instal-

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And, of course, the famous, Flintkote-developed *Hydralt** protective coating in its many forms. These mineral colloid, asphalt emulsions won't flow under heat or carbonize under exposure. By test and by experience they *outlast any other known form of bituminous coating exposed to weather.*

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★ ★ ★

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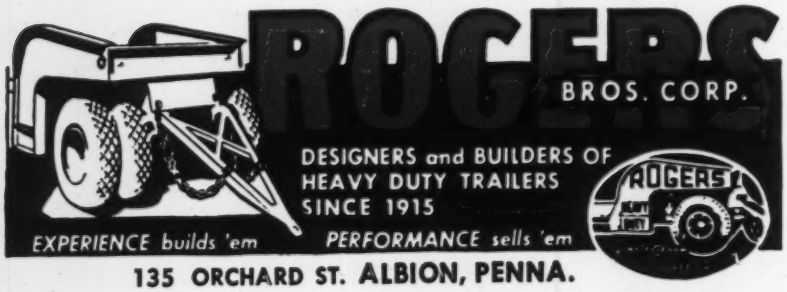

135 ORCHARD ST. ALBION, PENNA.

lation of service facilities in building. —*Detroit Steel Products Co., 3141 Griffin St., Detroit 11, Mich.*

Power Cranes—(16-p. booklet) Deals with both rubber-tired and crawler mounted Lorain cranes for industrial material-handling jobs. Illustrations show use of fifteen typical attachments including buckets, hooks, electric magnets, slings and tongs. Booklet emphasizes mobility of Lorain cranes. *The Shovel Co., 1404 Terminal Tower Cleveland, Ohio.*

Portable Centrifugal Pump—(4-p. folder) Compact, lightweight, portable centrifugal pump designed especially for utility company service. Sizes of self-priming units are 1½ to 3 in., and weights range from 64 to 135 lb. Space requirements are from 19x, 20x, 10 in. to 21½x, 26x, 19 in. Typical 2-in. model moves 6,000 gal. per hr. at 5-ft. suction lift. Performance tables show results of actual tests. Four models, powered by four-cycle engines, guaranteed to prime automatically at suction lifts to 28 ft. high at sea level.—*Marlow Pumps, Ridgewood, N. J.*

Welding Service—(14-p. booklet) Describes organization and facilities for welding services of all types, including fabrication, repairs, maintenance, structural steel erection, tanks, pipe lines and railroad work. Staff of skilled workmen includes mobile service forces for dispatch to job where needed. May be hired by day or week.—*The Hallen Co., Inc., 45-24-37th St., L. I. City, N. Y.*

Glass Blocks—(24-p. booklet) Describes and illustrates applications of glass block in home construction and suggests new ideas for home owner and builder. Typical installation details are given. Information on light transmission, thermal insulation, solar heat gain and estimating data, and sizes and shapes of glass block available. Drawings give details for exterior openings and for special interior uses.—*Pittsburgh-Corning Corp., 632 Duquesne Way, Pittsburgh 22, Pa.*

Baseboard Heating Unit — Leaflet deals with rittling baseboard heating unit rated at 1020 B.t.u. per lineal foot at 1 lb. steam with air temperature at 65 deg. F. Unit combines convected and radiant heat, eliminating unsightly radiators and affords wall-to-wall free floor area.—*Rittling Corp., 1292-98 Niagara St., Buffalo 13, N. Y.*

Hydraulic Control Equipment—(4-p. folder). Bulletin 2-B deals with hydraulic pumps, rams and valves. Covers both power-driven and hand-operated

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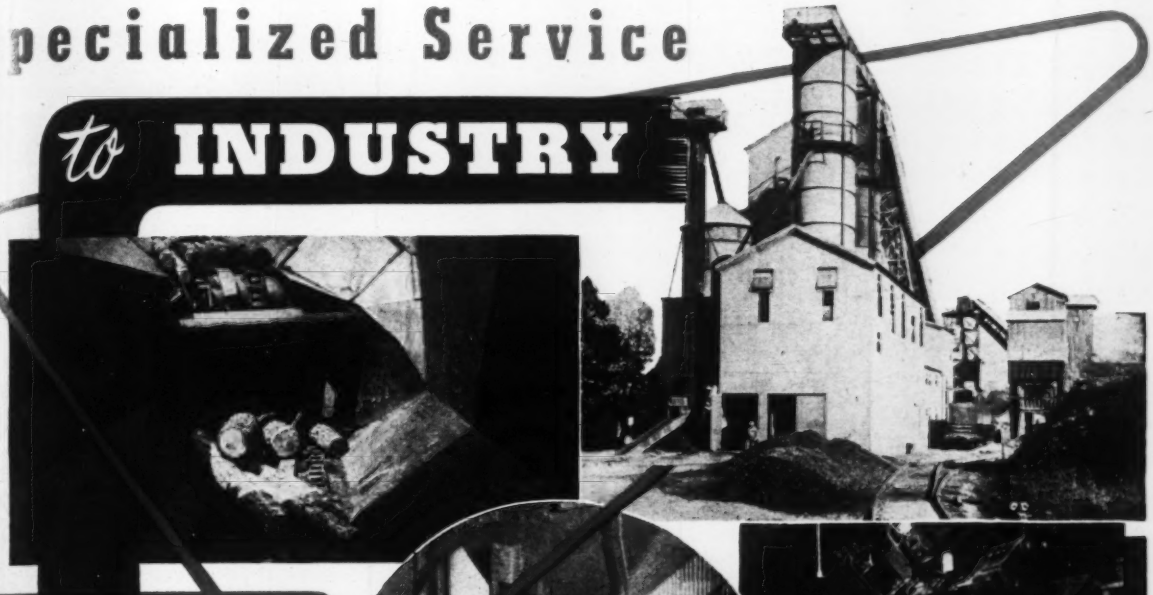

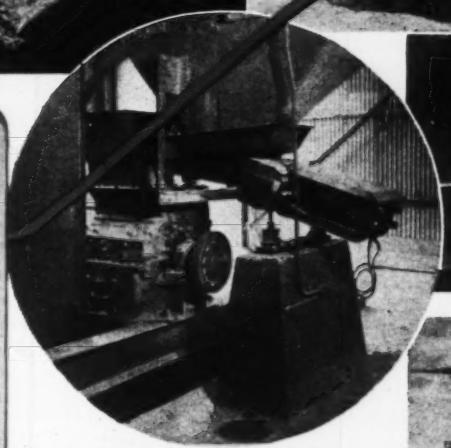

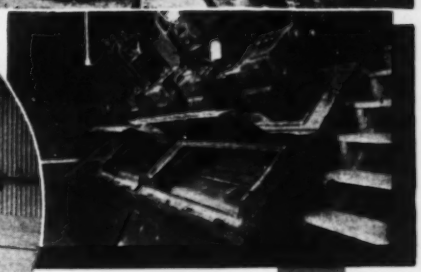

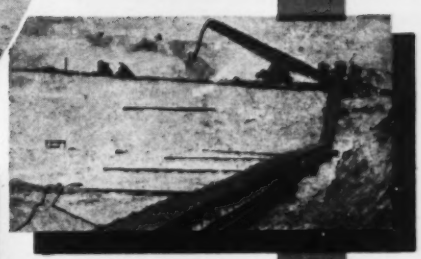

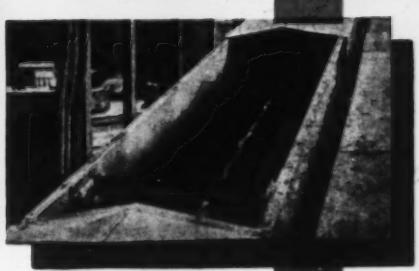

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See ad on page 113 for list of equipment in each line

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Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Miami, Allied Equip. Inc.
Jacksonville, Ogden Equip. Co.
Orlando, Highway Equipment and Supply Co.
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp.

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Crouchorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Minneapolis Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Seitz Machinery Co., Inc.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Haselton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Roswell, Smith Machy. Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
N. Y., Syracuse, Mid-States Contr. Equip. Co., Inc.
N. Y., Troy, Capitol Equip. Co.
N. C., Raleigh, Smith Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilgore Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andersen Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, San Antonio Machy. & Supply Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.

Va., Richmond, Highway Machy. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

La., New Orleans, Wm. F. Surgi Equip. Co.

Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Pittsburgh, Atlas Equip. Co.

Texas, El Paso, Equip. Supply Co.

Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Blue Brute Items

Worthington Pump and Machinery Corp.

Worthington-Ransome Construction Equipment Division

Holyoke, Massachusetts

pumps and control valves for single and double-acting rams. Also several types of auxiliary valves.—*Blackhawk Mfg. Co., Milwaukee 1, Wis.*

Heavy-Duty Diesel Engine—(28-p. booklet. Among subjects discussed are fundamentals of diesel power and its advantages, engine construction, patented combustion chamber and operation of 4-cycle engine with functional charts and diagrams, fuel injection equipment and governors. Cold engine starting is given attention; also fuel oil and lubrication. Hercules diesel engines have power range from 12 to 400 h.p. and piston displacement of 113.1 to 1468 cu.in.—*Hercules Motors Corp., Canton, Ohio.*

Rubber Pipe Joint—(leaflet) Tylox rubber joint is cast into bell of pipe by manufacturer, thus becoming integral part of the pipe. Applicable to small diameters up to large-bore reinforced concrete pipe sewers.—*Hamilton Kent Mfg. Co., Kent, Ohio.*

Drafting Templates—(4-p. folder). Range of templates includes ellipse set, detailer, radius guide, instrument symbols, architect's aid covering commonly used symbols. Templates made of cellulose nitrate are designed as time savers for engineers, designers, draftsmen and architects.—*Rapidesign, Inc., P. O. Box 592, Glendale, Calif.*

Skyhook—(4-p. folder). Aerial transportation device travels on and is supported by two wire rope cables anchored at both ends. Powered by industrial gas engine. Operator rides in Skyhook carriage to control operations. Traction is positive for climbing any grade.—*Pointer-Williamette Co., Inc., Portland, Ore.*

All-Steel Tool Box—(4-p. folder). Mounted on rubber-tired wheels for trailing to job at high speed. Equipped with shelves, partitions and safety cover lock.—*Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio.*

White Enamel For Industrial Interiors—(6-p. folder). Vita-Lux enamel is extremely white, tough, fast-drying with superior light reflection qualities for interior walls and ceilings. Explains how proper selection of paint brightens interiors of industrial concerns, improves worker morale, cuts down on accidents and increases production. Enamel is available in several finishes—gloss, semi-gloss, flat, undercoat and primer sealer to fit all requirements.—*Vita-Var Corp., Newark, N. J.*

Pile Hammers—(4-p. folder). Covers ten sizes of double-setting hammers, five single-acting hammers and two dou[ble] acting pile extractors. Gives specifi[ca]tions and illustrates variety of appli[ca]tions on bridges, piers and trestles.—*McKiernan-Terry Corp., 15 Park R[ow], New York 7, N. Y.*

Diesel Power Shovel—(12-p. bu[l]letin). Clutch-type 3½-4-cu.yd. dies[el] power shovel with electric swing. Tw[el]ve six diesel engine is direct-connected [to] generator which supplies power f[or] compact electric swing unit. Mediu[m] size machine is recommended for use [in] quarries and stripping. Machine [is] designated as Model 111-M.—*Mari[on] Power Shovel Co., Marion, Ohio.*

Valve and Curb Boxes—(4-p. folder). Describes new line of valve and curb service boxes made of asbestos-cement pipe with cast-iron tops and covers. Distinctive features include shock-proof joint to prevent damage to valves and curb stops. Chart indicates proper model to use for various trench depths.—*Verako Products Co., P. O. Box 604, Waukegan, Ill.*

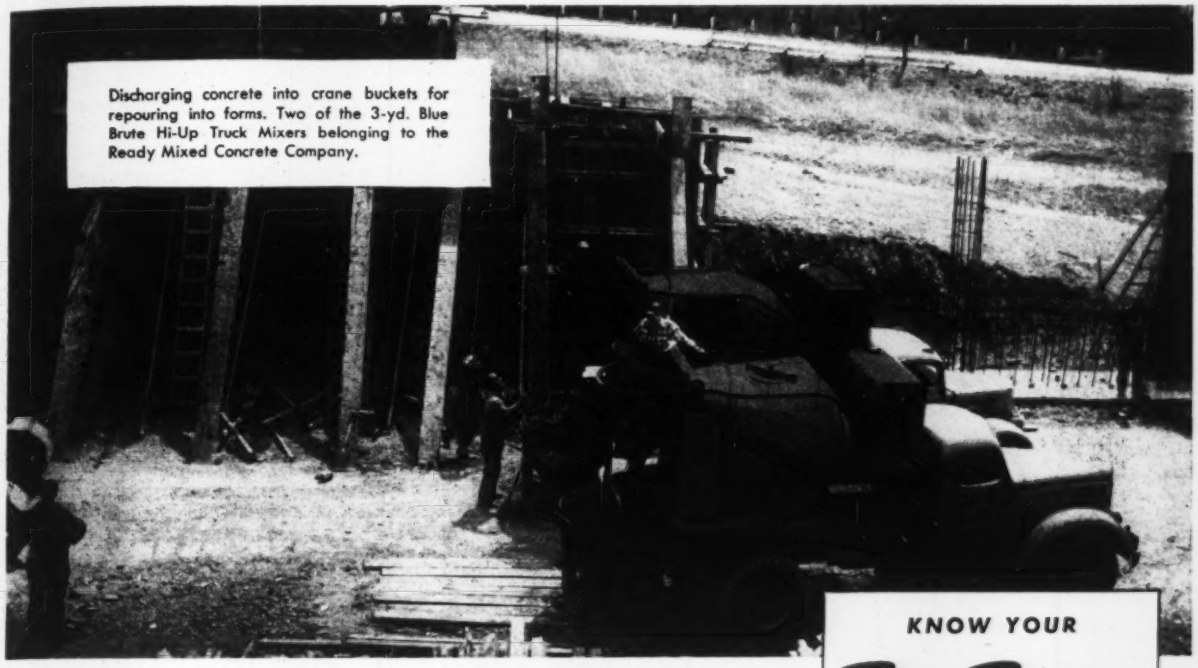
Metal Moulding—(68-p. booklet). Various sizes and types of stainless steel, aluminum, bronze and metal-covered wood mouldings. Also line of complementary tools including cutters, scribers, seam rollers, mitre boxes, hacksaws, tin snips. Included are snap-on mouldings, Tee-sections, angles, channels, flat-strips, oval tops, tubing and slip-in mouldings. Also counter-facings, coves, and edgings.—*Loxit Moulding Co., 1217 W. Washington Blvd., Chicago 7, Ill.*

Curb and Gutter Paver—A circular pictures and describes a self-powered curb and gutter paving machine which lays a minimum of five lineal feet per minute. It has a rapid eccentric tamping and strike off action before the screed and finishing trowel. It uses any standard concrete mixture graded from 1¼ in. down with lower slump for hand finishing.—*Datmar Industries, Inc., Kalamazoo, Mich.*

Metal Trims—This is a 5-color, 68-page reference book and catalog on metal trims and their uses. It shows more than 650 shapes and sizes of Chromedge metal trims and includes scores of detailed drawings with installation instructions and suggestions for decorative trim applications for single rooms or entire buildings.—*The B & T Metals Co., Columbus, Ohio.*

Diesel Engine Textbook—A great deal of general information about diesel engines is contained in a 28-page booklet. Among matters discussed are: Diesel power, engine construction, how combustion chamber functions, func-

HI-UPS HELP BUILD THE NATION'S HIGHWAYS



Discharging concrete into crane buckets for repouring into forms. Two of the 3-yd. Blue Brute Hi-Up Truck Mixers belonging to the Ready Mixed Concrete Company.

In every section of the country Blue Brute Hi-Up Truck Mixers are playing an important part in much needed highway construction. At Clinton Point, N. J., for example, these Blue Brutes are at work on a highway underpass and bridge on Route 28.

Owned by the Ready Mixed Concrete Company of Annandale, N. J., the Hi-Ups are carrying a total of approximately 5,000 cu. yds. of concrete to complete this job . . . and providing efficient, economical transport mixing with features like the following:

Ransome's exclusive mixing action . . . quick-charging hopper with non-jamming sealing door . . . simplified, trouble-free water system . . . simplicity of design with working parts easily accessible . . . and engineered flexibility that eliminates working strains.

Proved ability to mix better concrete at lower cost has made Blue Brutes familiar sights on highway and other big construction jobs of every type. It will pay you to learn how these Blue Brutes can help *you* save money and beat schedules. Get the whole story from your nearby Worthington-Ransome Distributor, or write for Bulletin 221. RS-2

KNOW YOUR

BLUE BRUTES

Your Blue Brute Distributor will be glad to show you how Worthington-Ransome construction equipment will put your jobs on a profitable basis. His name is listed on Page **112**.

RANSOME EQUIPMENT

Pavers, Portable and Stationary Mixers, Truck Mixers, and Accessories.

WORTHINGTON EQUIPMENT

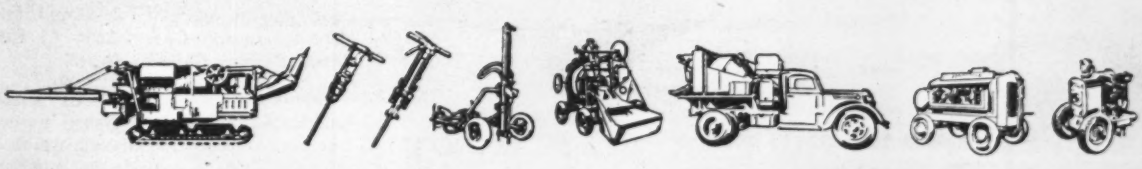
Gasoline and Diesel Driven Portable Compressors, Rock Drills, Air Tools, Self-Priming Centrifugal Pumps and Accessories.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.
Distributors in all principal cities

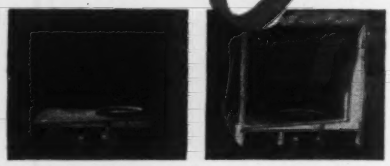
NATIONAL READY MIXED NRMCA CONCRETE ASSOCIATION

BUY BLUE BRUTES

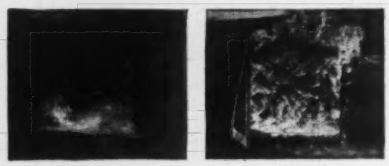


IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

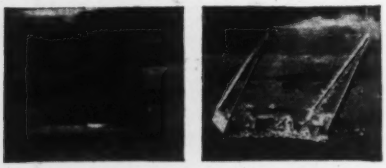
Tests Confirm fire retardance of KOPPERS CZC(FR)



Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.



Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.



After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

Continued burning reduced the untreated structure to ashes.

Above right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Koppers fire-retardant wood is suitable for use as flooring, roofing, sheathing and structural members of industrial buildings, garages, airplane hangars, munitions plants, docks and warehouse buildings, railroad engine houses, and other similar structures. Koppers CZC(FR) treatment has a valuable plus advantage, for it also fortifies the wood against decay and termite attack. Color and paintability are not harmed by the odorless CZC(FR) treatment.

Send for your copy of "Koppers Fire Retardant Wood." Filled with interesting and helpful information.

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PA.

tional charts and diagrams of the 4-cycle engine; and fuel injection equipment and governors.—*Hercules Motors Corp., Canton, Ohio.*

Solution Purification—A 24-page, color publication traces the development of de-ionization techniques and describes Dorr equipment and service now available for all types of ion-exchange work. It is explained that great progress has resulted from the development of synthetic organic resins or organatites, and ion-exchange applications has been broadened correspondingly. Of particular interest is a section about water treatment where deviations from normal ion-exchange are sometimes required.—*The Dorr Co., 570 Lexington Ave., New York 22, N. Y.*

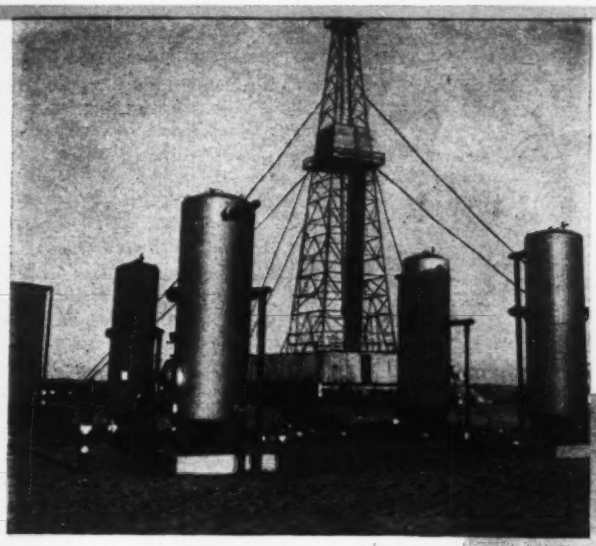
Industrial Air Compression—Publication of a bulletin on the new departmental system of industrial air compressor operation is announced. It is in the form of an article by Paul H. Davey, and describes departmental installations in detail. It it also compares the departmental plan with conventional centralized systems and lists the advantages of each. Installation diagrams and photos are included, together with complete departmental specifications.—*Davey Compressor Co., Kent, Ohio.*

Fluid Meters—This 40-page booklet is divided into ten different sections covering flow mechanisms, primary elements, integrators, auxiliary recorders, accessories, and installation features. Each section is illustrated by photographs and drawings of the equipment as well as by diagramatics which aid in understanding the operation. Also shown are representative chart records taken from actual Bailey fluid meter installations. These meters are supplied as indicators or recorders or both. They may also be equipped with a six-unit cyclometer type integrator which counts total fluid flow in gallons, pounds or cubic feet. They are easily adaptable to air-operated control.—*Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio.*

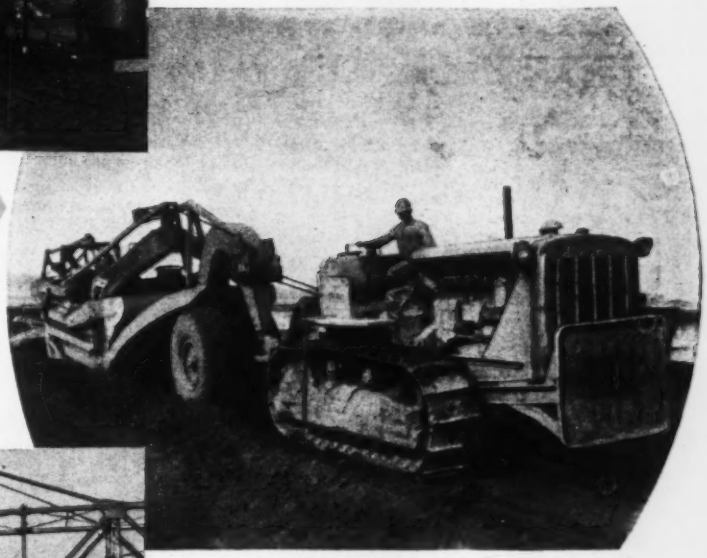
Incinerators—An interesting booklet catalogs and describes odorless incinerators of various types for hotels, restaurants, hospitals, schools, industrial establishments, municipalities and residences.—*Joseph Goder, 5121 N. Ravenswood Ave., Chicago 40, Ill.*

Insulating Roof Tile—An 8-page booklet describes the physical properties and construction specifications of the new Kaylo insulating roof tile. The manufacturer claims for it that it is easy to install and combines fire resistance, structural strength and insulation

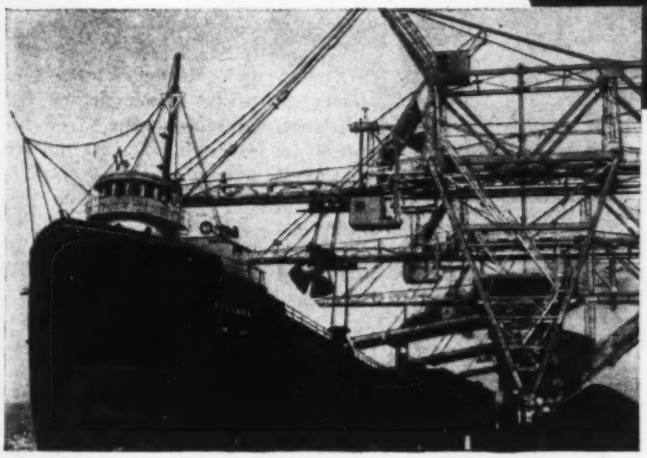
Improved Performance with LAY-SET PREFORMED



"Make hole" deeper—*faster*—is the demand in the oil fields. The deeper the hole goes, the greater the weight of drill pipe and tools. The faster it goes, the greater the shock loads in pulling and running in pipe. Hazard makes LAY-SET Preformed in Seale construction, with tough improved plow steel wires, and an independent wire rope core. LAY-SET's improved performance makes it THE rope for deeper, faster drilling.



The powerful "cat" and ravenous carrier-scraper cut down hills and fill in valleys. They make modern roads, airports, dams, and industrial sites—yes, even remove overburden in strip mining operations. Hazard's LAY-SET Preformed *Streamlined* Scraper Cable is designed for the tortuous sheaves and reverse bends that prove the quality of the rope. It will improve the performance of your equipment.



Coal and ore bridges hurry to load and unload ships and cars. The wire ropes travel fast as the 5, 10, 15-ton load speeds from ship to shore. Ropes whip. Quick starts and short stops mean extreme shock loads. Sharp steel edges mean cutting and abrasion. Tough conditions, but Hazard's LAY-SET is made in the right constructions for bridges. You can get the exact ropes that will improve performance and serve you best.

Whatever the field — logging, mining, building elevator, contractor, industrial, marine, or oil — Hazard wire ropes give you improved performance.

Ask your distributor for LAY-SET Preformed, Green Strand Wire Rope

ACCO

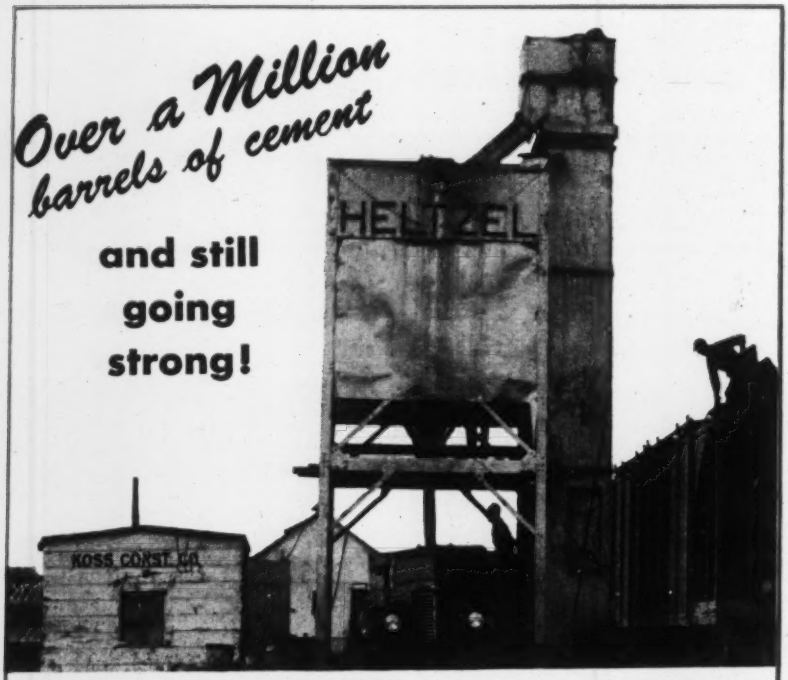
In Business for Your Safety

HAZARD WIRE ROPE

A DIVISION OF AMERICAN CHAIN & CABLE

TRADE MARK

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Tacoma, Seattle, Bridgeport, Conn.



VETERAN **HELTZEL** PLANT HAS REPAID ITS COST 42 TIMES OVER IN 17 YEARS . . .

• 1,160,500 barrels of cement have been unloaded by this plant. In 1931, time studies indicated the plant cost would be repaid at the handling of 25,000 to 30,000 barrels. (Note comments by Mr. Koss in the following letter.)

KOSS CONSTRUCTION CO.
General Contractors Since 1914
DES MOINES 9, IOWA

April 21, 1948

Mr. Donald T. Heltzel
Heltzel Steel Form and Iron Co.
Warren, Ohio

Dear Sir:

Our records indicate this bin was purchased by us in 1931. It has been used by us on paving projects all over the middle-west from that time until the present and is still a good plant and doing a fine job. During this period, we have unloaded 1,160,500 barrels of cement with the Heltzel, including box cars, hopper bottoms and truck delivery. You can be justifiably proud of the performance of this equipment.

Yours very truly,

Richard B. Koss
Vice President

RBK:m

Heltzel plants are products of specialized engineering, and constructed for lasting, trouble-free service. Your requirements for plants will be served best by Heltzel. Write for information and literature.

CONCRETE BUCKETS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

in a single roof deck material. Its light weight makes possible roof decks with a dead load, above the main purlins, of 12 lb. or less per sq. ft.—*American Structural Products Co., Toledo, Ohio.*

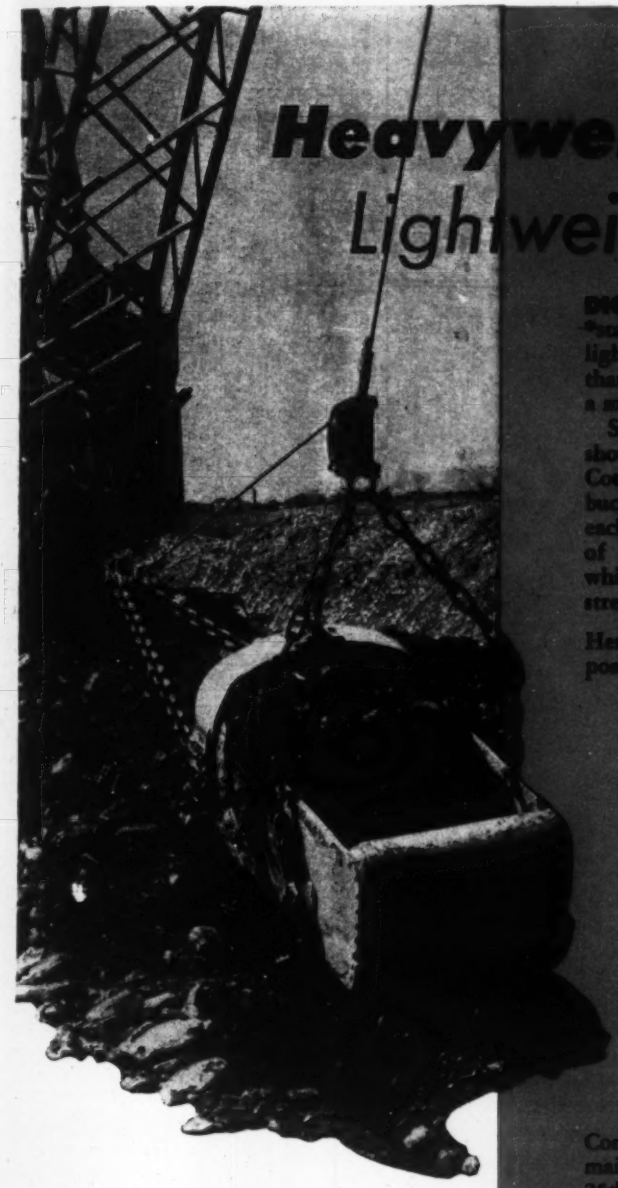
Mechanical Flow Meters—Ring balance mechanical flow meters are described and illustrated in a 12-page bulletin. The ring balance principle of operation is said to maintain high accuracy at low flows. Models include recording and indicating flow meters, indicating-integrating flow meters, steam flow-air flow boiler meters, dual-type meters and units for special applications.—*Hagan Corp., 323 Fourth Ave., Pittsburgh, Pa.*

Construction Products—(12-p. bulletin). Describes portable air compressors of two types, one of them mounted on a wheel tractor called the "Tractair" of 105 c.f.m. capacity. Also the complete LeRoi-Cleveland line of contractors tools, including paving breakers, rock drills, diggers, tampers, wagon drills and accessories, and a gasoline power mower and packaged generators. Bulletin is designated as CG-305.—*LeRoi Co., 1706 S. 68th St., Milwaukee 14, Wis.*

Oil-Testing Equipment—(8-p. pamphlet). Publication entitled "Taking the Guess Work out of Lubrication" illustrates methods within the skill of engine attendants for measuring contaminants in lubricating oil. Shows how to measure contaminants responsible for engine deposits, water, dirt and scuff metal and Fuel dilution. Equipment for conducting tests is described.—*Gerin Corp., P. O. Drawer 653, Red Bank N. J.*

Plaster and Mortar Mixer—(4-p. folder). Describes Power Hoe one-bag plaster-mortar mixer mounted on two wheels for fast towing. Handles up to 8 cu. ft. of material on some types of mixes. Blades are arranged to give criss-cross intermixing of material in drum. Powered by single cylinder air-cooled engine of 4½ hp.—*Jaeger Machine Co., Columbus 16, Ohio.*

Residential Steel Casement Windows—(8-p. pamphlet Fenestra casements are designed to fit industry-engineered houses of National Lumber Dealers Association. Liberally illustrated with architectural drawings including plans and perspectives. Pictures steel casements coordinated with other building materials to conform with modular standards. Installation details include drawings for frame construction and for masonry construction.—*Detroit Steel Products Co., 2250 E. Grand Boulevard, Detroit 11, Mich.*



Heavyweight * Stamina
Lightweight Speed . . .

DIGGING ROCK and boulders is a good test of the stamina of any bucket. And when a comparatively lightweight bucket stands up under this test it proves that the bucket has what it takes to do a job fast, with a minimum of maintenance and lost time.

Such a record has been made by the *ESCO* bucket shown at the left working on the Dorena dam near Cottage Grove, Oregon. Along with its endurance this bucket makes more passes an hour with more payload each pass than would be possible with heavier buckets of other makes. This is due to *ESCO* engineering which eliminates excess weight without sacrificing strength, and to *ESCO's* improved design.

Here are the features that make this performance possible:

Hollow Arch . . . greater strength than solid arch with less weight.

Clean Cutting Front . . . tooth horns integrally cast into cutting lip.

Flaring Outside Teeth . . . placed close to edges.

Shock and Wear Resisting . . . rigging and bucket parts made of *ESCO Manganese Steel* needn't be cast excessively heavy to allow for wear.

ESCO dragline buckets are made in four types —medium, stripping, standard and heavy duty. Capacities range from 3/8 to 20 yards.

Put an ESCO Bucket on Your Job

It's easy to find out how *ESCO* buckets will make your jobs easier and more profitable. Consult the nearest *ESCO* representative, or fill in and mail the coupon. Electric Steel Foundry, 2167 N.W. 25th Avenue, Portland 10, Oregon; 716 Porter Street, Danville, Illinois. Offices in Eugene, Oregon; Chicago; Honolulu; Los Angeles; New York City; San Francisco; Seattle and Spokane. In Canada, ESCO Limited, Vancouver, B.C.

ESCO 2½-yard standard weight dragline bucket on Northwest 80D machine with 60-foot boom. Contractor is Dorena Construction Co. (Guy F. Atkinson Co.; W. E. Kier Construction Co.; Bressi-Bevanda Constructors, Inc.; A. Teichert & Sons, Inc.).

* Webster says Stamina means capacity to endure strain; power of resistance; staying power.

ELECTRIC STEEL FOUNDRY
2167 N. W. 25th Avenue, Portland 10, Oregon

Please send information on ☐ Stripping Dragline
☐ Medium Weight ☐ Standard ☐ Heavy Duty

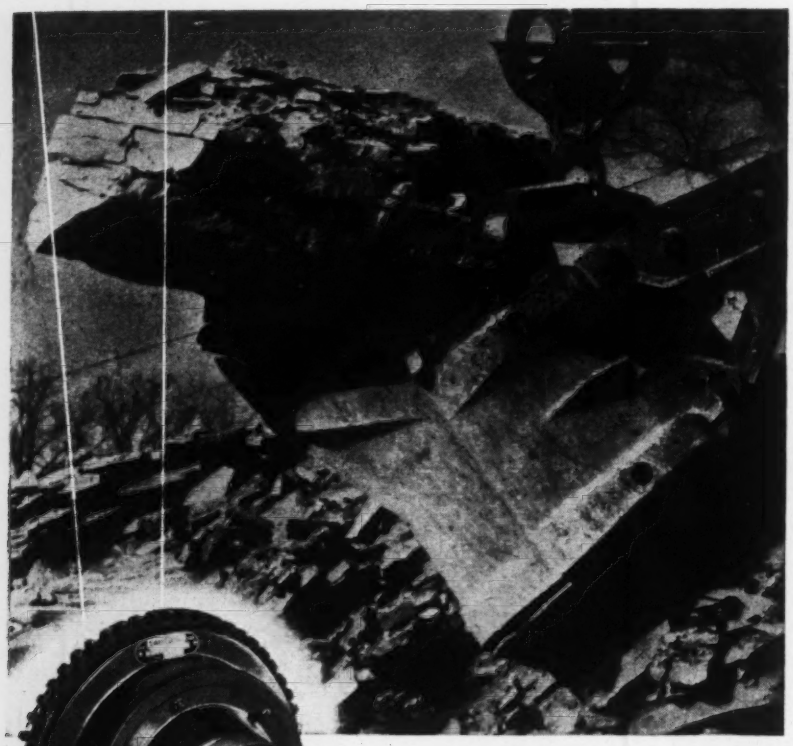
Name.....

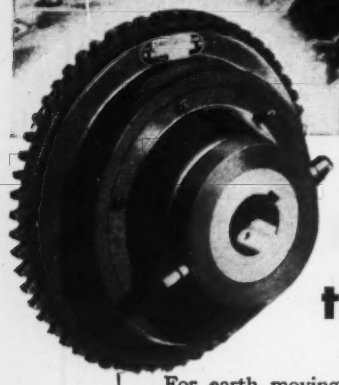
Address.....Zone.....

City.....State.....

ESCO

DRAGLINE and DIPPER BUCKETS





more RUGGED than ROCK...

For earth moving and material handling, the Twin Disc Model EH Clutch incorporates all the ruggedness that can be built into a clutch designed for heavy-duty service. In addition, these clutches provide easy engaging action, minimum overall dimensions, and maximum bores for oversize shafts. All moving parts are constructed and tested to insure accurate, statically balanced conditions.

Model EH Clutches are supplied with gear tooth drives for easy assembly. Readily attachable driving rings can be furnished for use with flywheels, drums and pulleys. Driving spiders can also be supplied with two types of hubs on sizes through the EH 324.

Twin Disc Model EH Clutches are available in single, two, or three-plate construction. Sizes range from 14" to 42" . . . working capacities from 65 to 875 hp. For complete specifications and engineering information, write for Bulletin 108-D. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

Reduction Gear

Hydraulic Torque Converter

Machine Tool Clutch

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Welding Curtain—(4.-p. folder). Flame-proof canvas and asbestos cloth curtains are designed to confine welding operations to a given area and protect other workers and passersby from harmful direct and reflected rays given off by welding operation. Furnished with eyelets across top.—*Industrial Products Co., 2715 N. 4th St., Philadelphia 33, Pa.*

Pre-Treated Paint Brushes—(12-p. booklet). Pre-treated paint brushes processed in best linseed oil require no breaking in. When working with water paints, oil processed bristles do not become floppy or sloppy. Bristles have proper setting—vulcanized in rubber.—*David Linzer & Sons, Inc., 10-20 Astor Place, New York 3, N. Y.*

Hydraulic Truck Equipment—Illustrated folders describe the Daybrook hydraulic power gate, the air entrained concrete body, trailer triple tandem hoists and hydraulic coal conveyor. The power gate automatically stops when it reaches a position flush with the truck body floor. Daybrook triple tandem hoists are designed to handle any load capable of being transported over the roads on a trailer.—*The Daybrook Hydraulic Corp., Bowling Green, Ohio.*

Tank Lining—Three folders describe acid and alkali-proof tank lining and resin coating, and acid and alkali resistant resin coating under the trade designations at Nukemite 24, 35 and 40. In regard to No. 35 it is said that it was developed expressly to combine the ease of application of a liquid coating with the immunity and long service life of good sheet membrane linings, which will not adhere to a surface by themselves and require special application skill, thus adding to the cost. Nukemite 35, after drying completely is leakproof, odorless, tasteless and non-contaminating, it is indicated.—*Nukem Products Corp., Buffalo 20, N. Y.*

Design Data—A supplementary bulletin entitled "How to Use Meehanite Design Data" has been prepared to aid the user of Meehanite Bulletin No. 26 entitled "Formulas for Computing Maximum Stresses and Deflection in Circular Flat Plates."—*Meehanite Metal Corp., Pershing Square Building, New Rochelle, N. Y.*

Crushers, Conveyors, etc.—A 78-page catalog lists crushers, conveyors, elevators, screens, classifiers and other Kennedy products which are very extensive, many of them of interest to contractors and constructors.—*Kennedy Van Saun Mfg. & Eng. Corp., 2 Park Ave., New York 16, N. Y.*

Roof Ventilator—Circular describes a roof ventilator designed to utilize the power of air currents coming from all angles to provide positive ventilation without down drafts. It can be used for commercial, industrial and residential buildings.—*G. C. Breidert Co., 3129 San Fernando Road, Los Angeles 41, Calif.*

Power Grader—A bulletin describes a power grader for heavy-duty grading, ditching, filling and road building jobs. It illustrates the M-B Power Grader operating with such attachments as a power sweeper, scarifier, snow plow and equipped with leaning wheels and extra large rear tires. Complete specifications for both the 40 H.P. gasoline or Diesel powered models are provided—*Meili-Blumberg Corp., New Holstein, Wis.*

Single Stage Centrifugal Pumps—For the first time, De Laval single stage pumps have been included in a comprehensive catalog presenting outstanding features of design and construction, listing pump ratings and incorporating essential dimensions. With this catalog, engineers can select the required pump, estimate motor size and plan approximate installation dimensions. In replacing several separate leaflets the one catalog now contains information for all G, I, K, L, M and P single stage, single and double suction pumps. The catalog also gives brief descriptions of such optional features as mechanical shaft seals, self-priming systems and vertical mountings.—*De Laval Steam Turbine Co., Trenton 2, N. J.*

Welders' Guide—A booklet is filled with useful welding information. It gives the characteristics of various welding arcs, 4 essentials of proper welding procedures, types of joints, typical positions, chart of standard steel shapes, photographs of good and bad welds, causes of common welding troubles and what to do about them, welding symbols, and an easy-to-use table of "How to Find" formulas.—*Hobart Brothers Co., Troy, Ohio.*

Internal Combustion Engine Valves—An exhaustive article on internal combustiton engine valves appears in the July, 1948, issue of "Lubrication." It is of interest and value to any user of such engines, and may be obtained free by writing to—*The Texas Co., 135 East 42d Street, New York 17, N. Y.*

Submersible Pump—(4-p. bulletin) Close-coupled pump and motor units for operation while completely submerged. Motor is oil-filled and sealed for underwater operation. Pumps may be any one of several different

FOR FAST AND LOW COST ACCURATE KNOWLEDGE OF BEDROCK CONDITIONS

Empire HYDRAULIC TESTING DRILL

When you drill to bedrock you want to know your subsurface conditions—but at LOW COST. Here is the rig that you can transport and set up easily and economically in rough country, with a couple of men if necessary. Designed especially for this class of work. Extensively used by U. S. and State Governments and many others. Extremely strong and simple.

•*Easy to transport, setup, take down*

JUST THE DRILL FOR ROUGH COUNTRY

Outfit weighs only a total of 800 lbs. for 50 ft. drilling depths. Gives accurate samples of materials drilled. Every part can be handled by one or two men. Send for descriptive circular giving complete specifications. It will help if you advise us regarding drilling depths and general nature of work.

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75 WEST ST., NEW YORK, N. Y.
Works: YONKERS, N. Y.

A TRADE-MARK OF
Special Significance
TO YOU

WISCONSIN
HEAVY-DUTY
Air-Cooled ENGINES

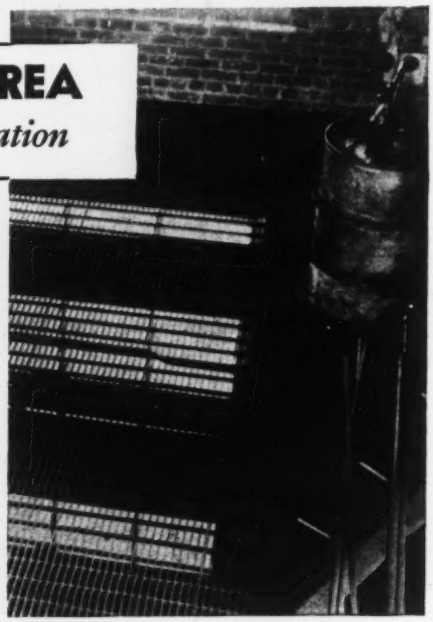
The recently adopted trade-mark reproduced above, an attractive decal of which is placed on every Wisconsin Engine that leaves our plant, should be of particular interest to you . . . as a manufacturer, designer, or user of engine-powered equipment.

"Most H. P. Hours," as applied to Wisconsin Air-Cooled Engines, is today establishing a new measure of engine value. Its significance lies in the fact that it accurately expresses the thing you pay for and in which you are most interested — *maximum horsepower hours of dependable, on-the-job service.*

It's a point well worth remembering, and acting upon.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 14, WISCONSIN

90% OPEN AREA
for light and ventilation



THE illustration shows the admission of light through three floors where the flooring is Hendrick Mitco.

Not only does pressure-formed Hendrick Mitco Open Steel Flooring have 90% open area, but there are no bolts, rivets or angle irons to collect dirt and refuse. The square-edge, uniformly spaced, rectangular steel bars provide a non-slipping, level walking surface. There is no lateral deflection, however heavy the loading, because each Mitco panel is a strong, integral unit.

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HENDRICK
Manufacturing Company
45 DUNDAFF STREET, CARBONDALE, PENNA.
Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

centrifugal or turbine types. Capacities range from 100 to 7,000 gpm. and motor sizes from 7½ to 350 hp. Can be installed in any position: vertical, horizontal or on an incline.—*Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles 54, Calif.*

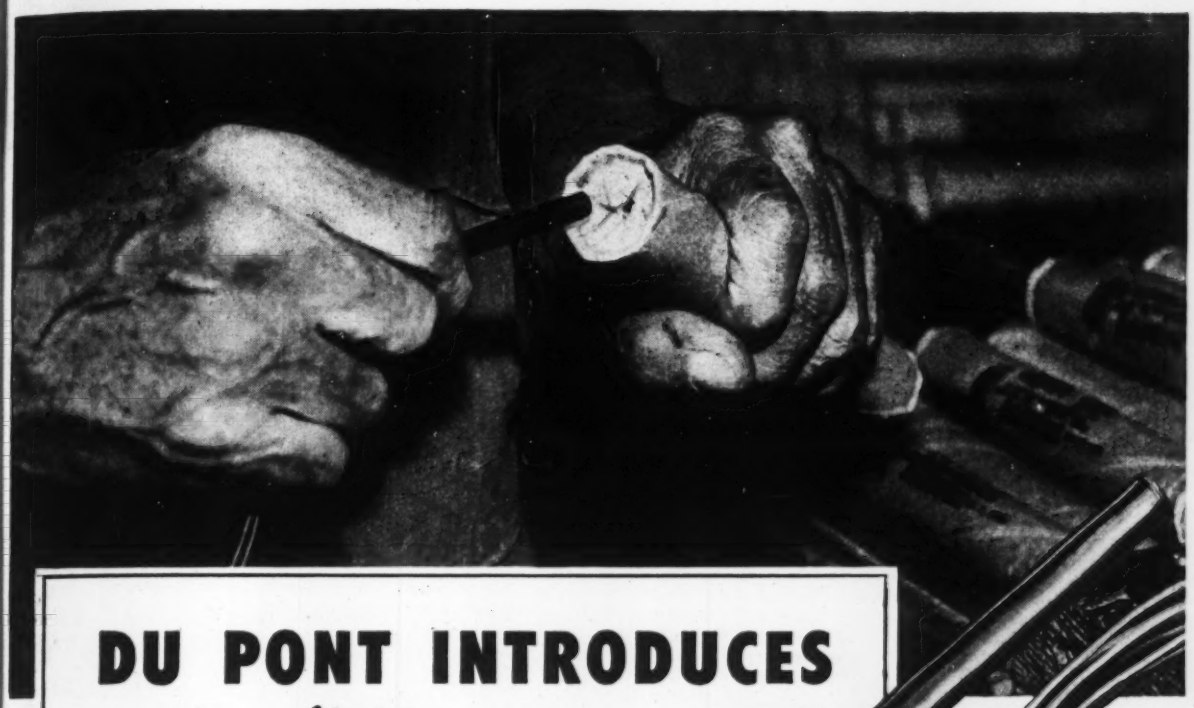
Chemical Products—(16-p. booklet) Classifies Hercules Powder Co.'s chemicals by family groups including cellulose, synthetic resins, rosin terpene solvents and chemicals, chlorinated products, dairy products, explosives and sporting powders. All of the products listed are briefly described as to chemical makeup, uses and potential applications.—*Hercules Powder Co., Wilmington, Del.*

Hose Fittings—(6-p. pamphlet) Catalog pages cover couplings of several types, hose nipples and a variety of air and gas hose fittings. Featured are recommendations for attaching couplings to hose. There is also a table showing the various couplings recommended for different types of hose and a detailed discussion of coupling threads and their functions. Each fitting is pictured and described, with sizes available listed.—*B. F. Goodrich Co., Akron, Ohio.*

Underground Pipe Insulation—(4-p. folder) Describes "Z-Crete", a special mix of insulating concrete designed particularly for the insulation of underground heated piping. Product is composed of specially graded and compounded insulating aggregate, Portland cement and a liquid waterproofing admix. These materials are mixed and placed on the job and cast in place to form a solid covering of water-repellant insulation. Leaflet describes method of installation and all necessary instructions.—*Universal Zonolite Insulation Co., 135 So. LaSalle St. Chicago 3, Ill.*

Motor Scraper—(12-p. booklet) Illustrates motor scraper in action and details of its construction. Also detailed specifications for TS-300 machine.—*LaPlant-Choate Mfg. Co., Cedar Rapids, Iowa.*

Lightweight Pumps—(4-p. folder) Describes characteristics, performance and uses of lightweight centrifugal self-priming pumps. Three sizes, include Midget 1½-in., the Hawk 2-in. and the Eagle 3-in. Bulletin 7LW-1 describes improved priming principle. Weights of pumps range from 62 to 117 lb. All models are constructed of cast aluminum for lightness and are equipped with carrying handles making them easily transportable.—*Gorman-Rupp Co., Mansfield, Ohio.*



DU PONT INTRODUCES *the "Series B"*

A New and Improved Series of Delay Electric Blasting Caps for Contractors and Ore Miners

These new caps offer contractors and underground metal miners new speed and even greater dependability in blasting operations. "Series B" caps are designed to eliminate misfires due to arcing or "water hammer." They bring increased reliability under the most adverse blasting conditions: high voltages, parallel circuits, and under water.

"Series B" caps embody all the advantages of the present line of Du Pont Delay Electric Blasting Caps: double crimp casing, rubber plug closures, nylon-insulated leg wires, aluminum-foil shielded shunts. Dimensions are the same . . . as are the 10 delay periods.

"Series B" caps can be used in any of the usual hook-ups . . . series, parallel-series, or parallel . . . with or without instantaneous blasting caps . . . and under wet or dry conditions. They fire with equal certainty on low, medium, or high voltage.

If you employ rotational firing—particularly if you use high voltage and have wet work—investigate Du Pont "Series B" delays. Ask any Du Pont Explosives representative for full information about this *new* product of Du Pont Explosives Research.

E. I. du Pont de Nemours & Co. (Inc.)
Explosives Dept., Wilmington 98, Del.

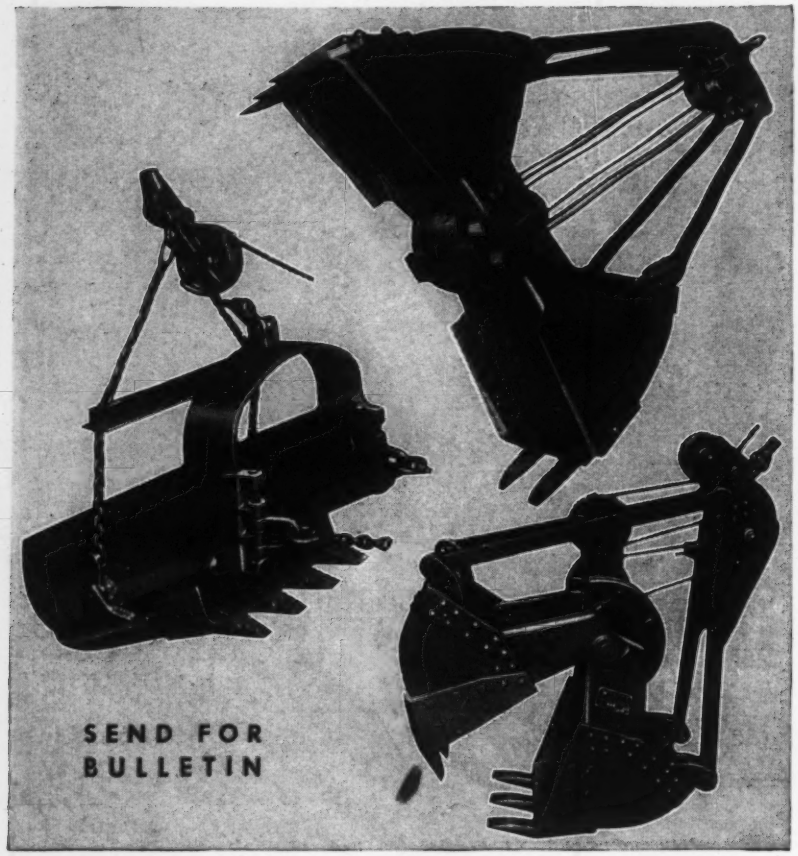
DU PONT EXPLOSIVES

Blasting Supplies and Accessories

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Be sure to visit the Du Pont exhibit—Booth 603—at the Metal Mining Convention—San Francisco—September 20-23, 1948.



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WELLMAN

Williams Type **BUCKETS**

• Count on longer life and more efficient service...due to Wellman original **welded rolled steel construction.** You get the maximum digging power, and exceptional strength—without excessive weight! Specify Wellman, and you'll specify the best bucket for your purpose.

THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE • CLEVELAND 4, OHIO

MacArthur

38 YEARS INSTALLING PILES
OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER
SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION
18 EAST 48th STREET, NEW YORK 17, N. Y.
BOSTON • CINCINNATI • NEW ORLEANS

Elections and Activities

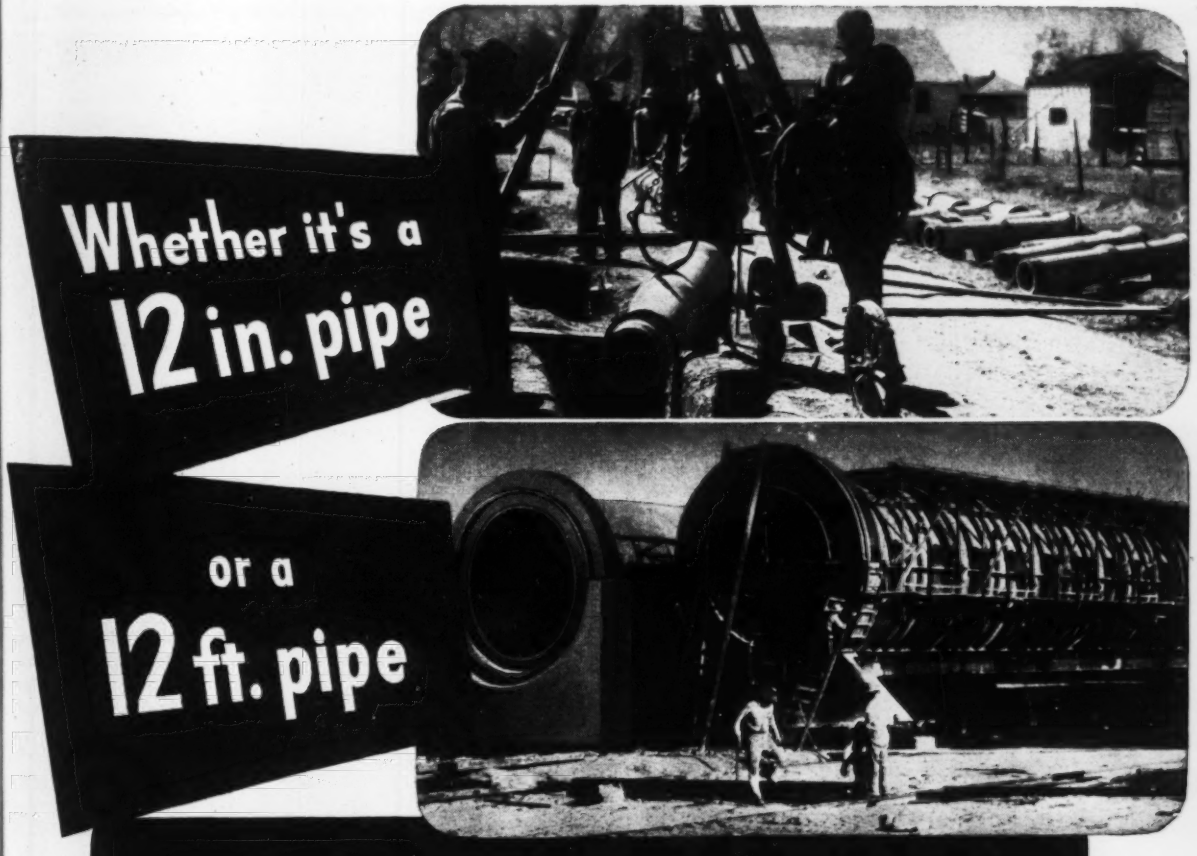
Henri B. Vidal has been installed as president of the Erie County Chapter, New York State Society of Professional Engineers. Other officers are: First vice-president, Elmer A. Hilburger; second vice-president, C. Arnold Dutton; corresponding secretary, John A. Beane; recording secretary, H. Dale Bossert; treasurer, Arthur B. Weaver, and directors, Edwin S. Bundy and George Steven.

The East Carolina Engineers Club was formed at a meeting at Wilson, N. C., May 26 with J. C. Gardner of Tarboro, retired division engineer for the North Carolina Highway Department, elected president. Kenneth Wright of Rocky Mount was elected vice-president, and W. J. Heard, city manager at Kinston, secretary-treasurer. The club is sponsored by the North Carolina Society of Engineers and has 79 charter members.

The Franklin Chapter of Professional Engineers, Columbus, Ohio, has elected the following officers: Myron T. Jones, president; R. M. Edgar, vice-president; Eugene W. Davis, secretary-treasurer. New functional directors elected are, —Paul E. Stilwell, Guy H. Elbin, Arliss C. Allen, Fabert F. Fisher, Millard K. Bowman, and Loring T. Hunziker. Directors at large are Cecil K. Rose and Robert F. Werner.

Central Ohio (Columbus) chapter of the American Society of Heating and Ventilating Engineers has elected William M. Myler, jr., Surface Combustion Corp., as president; Edward A. Norman, jr., Norman Products Co., vice president; Herbert G. Hays, Armstrong Furnace Co., secretary; and Robert S Curl, Robert S. Curl Associates, treasurer. In addition to the officers, members of the executive committee include M. R. Hamlin, S. W. Williams, and R. B. Breneman.

Franklin County (Columbus) chapter of the Ohio Society of Professional Engineers has elected: Myron T. Jones president; Col. R. M. Edgar, vice president; Eugene W. Davis, secretary treasurer; Robert E. Werner, and Cecil K. Rose, director-at-large; Guy H Elbin, representing county engineers. Fabert F. Fisher, representing public utilities engineers; Millard K. Bowman, representing municipal engineers; Paul E. Stillwell, representing state highway engineers.



CONCRETE
makes the ideal pipe

SMALL LATERAL SEWER or the world's largest pipe (12 ft. I. D. x 100 feet long, installed in the Los Angeles ocean outfall sewer at Hyperion) concrete pipe fits any sewerage, drainage or water line need as proved by its use in hundreds of communities throughout the nation.

Concrete pipe can be designed for practically any combination of engineering requirements and local or climatic conditions. When you specify concrete pipe you get:

STRENGTH AND DURABILITY to resist severe impact, to sustain heavy overburdens and to render long years of continuous, dependable service.

MAXIMUM HYDRAULIC CAPACITY because of its smooth interior finish; its clean, even joints, and the absence of tuberculation.

HIGH WEAR RESISTANCE to abrasion by suspended grit in high-velocity flow.

MINIMUM INFILTRATION AND LEAKAGE because of tight joints and uniformly dense concrete.

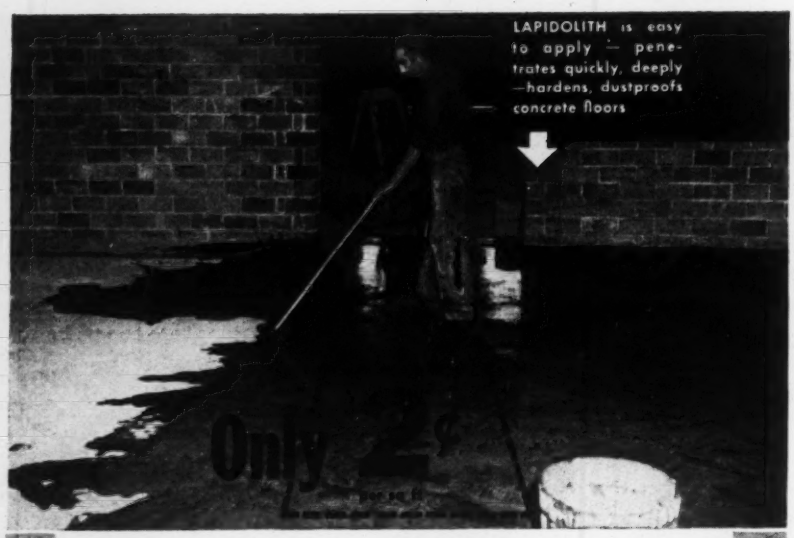
ECONOMICAL SERVICE because its moderate first cost plus its long life and small maintenance expense result in ***low annual cost,*** the true measure of economy and the taxpayers' goal.

These qualities make concrete the efficient, economical pipe material.

PORTLAND CEMENT ASSOCIATION

DEPT. 8a-17 • 33 W. GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work



to Insure Concrete Floor Investment with LAPIDOLITH

(PATENTED)

Have you ever stopped to think how much concrete floors cost? A substantial investment! Yet for *as little as 2¢ per sq. ft.* you can insure that investment—make concrete floors wear better, last longer — cut down repair and replacement costs.

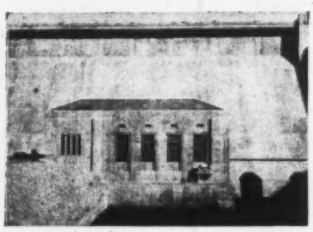
How? It's easy. Apply LAPIDOLITH, *the liquid chemical concrete hardener that can't be copied.* Makes floors substantially harder — guards against wear, concrete dusting, many oils and chemicals.

EASY TO APPLY

Lapidolizing is as easy as washing the floor. No work schedule interruptions . . . one treatment does the job. *The first cost is the only cost.*

Thousands of concrete (and terrazzo) floors everywhere — *old and new* — are protected the easy, economical LAPIDOLITH way. Get the facts!

HELPFUL NEW FOLDER — See SWEET's, or send for illustrated folder packed with floor-protecting, money-saving facts. Write Dept. E7.



Concrete floors in the Norfolk Dam power plant (Mountain Home, Ark.) are LAPIDOLITH-treated

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"BUILDING SAVERS"

If It's Worth Building It's Worth Saving

Floor Treatments • Waxes • Paints and Protective Coatings
Concrete and Mortar Admixtures • Waterproofing and Dampproofing
Caulking Compound • Roof Coatings

Building Products Division L. SONNEBORN SONS, INC. New York 16, N. Y.

In the Southwest: Sonneborn Bros., Dallas 1, Texas

Men and Jobs

Earl M. Rades, engineer for Dade County, Fla., has resigned.

Harold H. Compton has been appointed executive assistant to Chief Engineer Betram Tallamy of the New York State Department of Public Works succeeding Thomas Watkins, retired. For many years Mr. Compton was a teacher in Rensselaer Polytechnic Institute, resigning in 1941 to join the Navy Civil Engineering Corps as a lieutenant commander, during which he saw service in the Pacific. Since his release from the Navy in 1945, Mr. Compton has been in New York State Department of Public Works as a senior civil engineer.

L. E. Hough has been named city engineer at Aberdeen, Wash., to succeed Ed Bowen, resigned. A civil engineering graduate of the University of Washington, he most recently has been city engineer at Ontario, Ore., after wartime service.

M. J. Cobert of Winnipeg has been named chief engineer of the Manitoba Mines & Resources Department.

Clayton R. Haden has become division engineer for the U. S. Public Buildings Administration at Boston, Mass., succeeding **William A. Miller,** now in the PBA office in Philadelphia. Mr. Haden went to Boston from the Public Buildings Administration office in Denver, Colo.

Col. R. L. Dean, Westerly, R. I., has become chief district U. S. Army engineer, Rovk Island, Ill. He served in the war in the Pacific and in Japan, and received the Legion of Merit and Oak Leaf Cluster. He was graduated in 1924 at the U. S. Military Academy, West Point, and later served there as an instructor. Before the war he served as assistant district engineer and assistant division engineer, U. S. Army Engineers, St. Louis, Mo.

Edwin F. Koester, of Wilmington, Del., has been named chief engineer of the Wilmington street and sewer department. He was engineer in charge of development of plans, survey and traffic, and succeeds Harry L. Maier, retired. **Earl D. Krapf** has been appointed assistant chief engineer. A veteran, he has been an engineer in the street and sewer department of Wilmington.

PROFITABLE PAYLOAD EVERY TIME!

HERE ARE THE REASONS

WHY!

- ★ 20% to 40% lighter than other buckets, type for type.
- ★ All welded construction for greater strength and durability.
- ★ 12% Manganese Steel chains, fittings, and reversible tooth points.
- ★ Full Pay Load every trip, even in wet digging.
- ★ Perfect Balance; handles easier, fills faster, dumps cleaner.
- ★ Three Types: light, medium, and heavy duty. ***With or Without Perforations.***

HENDRIX *Lightweight* DRAGLINE BUCKETS

3/8 to 40 Cubic Yards

Every time you hook up a Hendrix "Lightweight" you're certain of a full payload in less time with greater ease. Hendrix Dragline Buckets are designed to increase your profits on any digging job and at the same time cut down your operating and maintenance cost. The strength of a solid mass is maintained, yet weight lessened, through a scientific arrangement of perforations. We took the weight ***out of the bucket*** to let you put it ***inside!***

Write for descriptive literature or ask your dealer.

HENDRIX MANUFACTURING COMPANY
MANSFIELD INCORPORATED LOUISIANA

15,000 V.P.M. IN CONCRETE

FLEXIBLE SHAFT SPEED ONLY 3,600 R.P.M.

This amazing step-up in frequency of the vibrator head is made possible by a patented, non-eccentric rotor device found only in Vibro-Plus vibrators.

30% HIGHER FREQUENCY

- save 500% on labor
- save as much as a bag of cement per cubic yard.
- concrete of uniform strength and density

LOW SPEED FLEXIBLE SHAFT

- less mechanical wear and tear • longer unit life

No time is lost for periodic stripping down. The flexible shaft can be lubricated in less than 20 seconds. THE VIBRATOR HEAD RUNS DRY.

Vibro-Plus is designed and built for long, uninterrupted work periods.

Write for technical booklet giving information of profitable interest to everyone associated with concrete construction.

VIBRO-PLUS CORPORATION
243 W. 55th St. N. Y. C.

A few choice territories available for distributors

New LIGHTWEIGHT ELECTRIC PLANT

5000 WATTS D.C.

Weighs only 315 lbs.!

Model 5CK-115M, 5,000 watts, 115 volts D.C.

Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete . . . ready to go!

NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages. COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts.
ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. IB: 1-cylinder, 3¼ HP.

Onan PRODUCTS

Write for catalog

D. W. ONAN & SONS INC.
5379 Royalston Ave., Minneapolis 5, Minn.

ONAN ELECTRIC PLANTS

Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

Sales—Dan Ebberts is national sales manager for the MADSEN road construction equipment . . . Ralph L. Wolf is central district sales manager for the BUFFALO-SPRINGFIELD ROLLER CO., of Springfield, Ohio . . . Bob Baldwin is Illinois sales manager for J. P. WAITE, INC., Milwaukee, Wis., distributor of BUCYRUS-ERIE HYDROCRANES and WARNER & SWASEY GRADALLS . . . K. F. Whitfield is advertising and sales manager of WALKER-TURNER division of KEARNEY & TRECKER CORP., Plainfield, N. J. . . . Another large increase in the branch and regional sales and service staffs of BROWN INSTRUMENT CO., in 20 cities in different parts of the country is planned. . . . C. S. Wileman is district sales manager at Wilkes-Barre, Pa., for LINK-BELT CO. . . . Fred P. Lamon is sales representative for the UNIVERSAL CONCRETE PIPE CO., in the Decatur, Ala., territory . . . Robt. H. Taylor is territory salesman for the PENNSYLVANIA RUBBER CO., in Washington, northern Idaho and Montana. . . . Expansion of sales and service facilities for the CUMMINS ENGINE CO., INC. of Columbus, Ind., is taking place at Omaha, Neb. Kendall L. Vinton is manager of the dealership there. . . . V. W. Blackney is director of sales in the distribution division of the U. S. RADIATOR CORP. . . . Dell W. Savage is eastern sales manager at New York for the THEW SHOVEL CO. . . . F. L. Sargeant is manager of the New York sales division of REYNOLDS METALS CO. . . . L. H. Crafts is now vice-president and general sales manager of UNIVERSAL MOTOR CO., Oshkosh, Wis. . . . H. T. Anderson is assistant to the general sales manager of the WORTHINGTON PUMP and MACHINERY CORP., Harrison N. J. . . . PITTSBURGH CORNING CORP., recently held a sales seminar at the Port Allegany, Pa., plant. . . . Wm. J. Thomas is general sales manager of the BABCOCK & WILCOX TUBE CO., Beaver Falls, Pa.

Personalities—Arthur J. Bulger is a director and executive vice-president of VACUUM CONCRETE INC., Philadelphia, Pa. . . . John K. Dolan is district manager at Kansas City, Mo., for MARION POWER SHOVEL CO. . . . B. R. McBath is now general manager of the RANSOME MACHINERY CO., Dunellen, N. J. . . . Wm. H. Shank is advertising man-

EVEN HARD-FROZEN ICE WON'T BALK A NELSON SNOW LOADER

Nelson 10-yard-per-minute snow loader owned by the Port of New York Authority. This *complete unit* is well within the budget of even small communities.

YEAR 'ROUND USEFULNESS — A Nelson is a full-time worker. Extra boom quickly converts it into efficient bucket loader.

. . . IT PICKS BEFORE IT SHOVELS!

Ice storms, quick freezes, hardened snowbanks — biggest snow-clearance headaches in most cities—are routine short order jobs for a Nelson Snow Loader. That's because a Nelson is more than a "conveyor-type" machine. *It picks before it shovels.* Tough, steel-toothed, renewable feeder blades dig deep and close, make short work of frozen snow.

A sensitive valve gives operator close control of depth of cut, protects pavement. Operators like the way a Nelson maneuvers in traffic; they like the quick adjustability of the Nelson hydraulic hoist and swivel chute.

The man who pays the bill likes a Nelson's year-'round usefulness. It handles coal or cinders without a change. A Nelson bucket boom, separately available, speedily converts the same chassis into a rugged bucket loader for road or pit, handling sand, earth, gravel or broken stone.

By all means get the facts and costs on the Nelson—and see it perform—before you invest in a snow loader. Thrifty "Utility" or big "Heavy-Duty" sizes. Write for new bulletin.

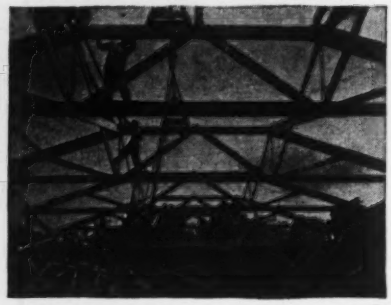
NELSON

N. P. NELSON IRON WORKS, INC.
CLIFTON, NEW JERSEY · *Truck Loaders Since 1917*

CUT YOUR COSTS IN HALF

with

LANK-TECO Trusses



Such saving has been accomplished by Timber Engineering Company's design of a combination pitch-flat-top roof truss (illustrated)—simple in design, economical, *proved superior!*

HERE'S WHY

Lank-Teco saves construction costs. Details are simplied so that lay out and fabrication of the trusses is done quickly. You also save up to 50% in materials and hardware with Lank-Teco trusses.

TEST PROOF

of Lank-Teco superiority: under test, a 50′ Lank-Teco truss span was loaded to full design load of about 25,000 lbs., for 7 months, which was double the designed for time of loading. Despite the long loading period, results were: deflection only one-half that of similar span flat-top truss also tested. The Lank-Teco truss was overloaded to failure after seven months and carried almost 2½ times design load before failure.

FREE DESIGN DATA

Typical Designs for 40′, 48′ and 60′ spans are available—yours for asking us!

WRITE TODAY

TIMBER
ENGINEERING COMPANY
WASHINGTON, D. C.

Please send FREE Design Data for size span checked
40′ ☐ 48′ ☐ 60′ ☐

Name .....

Company .....

Street ..... State .....

ager of HARDINGE CO., INC., York, Pa. . . . Stanley R. Shepard is district manager at Albany, N. Y., for MARION POWER SHOVEL CO. . . . Douglas E. Dreier is in charge of the engineering service department of WALKER PROCESS EQUIPMENT INC., Aurora, Ill. . . . Peter Robertson is assistant to the district manager of REPUBLIC STEEL CORP'S., Cleveland district. . . . Robt. A. Morris is assistant to the president of the ACME STEEL CO., Chicago. . . . A. C. Booch is general manager of the Springfield, Ill., operations of ALLIS-CHALMERS of Milwaukee, Wis. . . . J. C. Garrison has joined the engineering department of TIMBER ENGINEERING CO., Washington, D. C. . . . H. L. Glinn, export sales manager of the GALION IRON WORKS & MFG. CO., Galion, Ohio is making an 8 weeks air trip to the Far East and South Pacific. . . . John G. Seiler is executive vice-president of TUBE TURNS, INC., Louisville, Ky. . . . Donald M. Willard is superintendent of the construction department of LUKENS STEEL CO., Coatesville, Pa. . . . A. Vail Spinosa, executive vice-president of PENN METAL CO., INC., at Parkersburg, W. Va., has retired after 22 years.

Distributors—John D. Talbott is district representative of GALION IRON WORKS & MFG. CO., in North and South Carolina, Florida and Georgia. . . . R. B. Hazard is manager of distributor sales, Western district for MANHATTAN RUBBER division of RAYBESTOS MANHATTAN, INC. . . . FUCHS-CLAYTON MACHINERY CO., represents BARBER-GREENE construction and industrial division in western Iowa counties and all of Nebraska. . . . Wm. W. Hickey represents FLEXIBLE STEEL LACING CO., in New England and New York territory. . . . A district office, serving Ohio, Kentucky, West Virginia, Western Pennsylvania, and Indiana, will be opened in Columbus, Ohio, by the IRVINGTON FORM & TANK CORP., of New York City. A. G. Miller will be district manager.

Deceased—Albert G. Bladholm, president of IRON & STEEL PRODUCTS, INC., Chicago, Ill., died recently. . . . James E. Lowey, Philadelphia branch manager of the HOMELINE CORP., Port Chester, N. Y., died recently in Centerville, Md.

Miscellany—AMERICAN FLOOR SURFACING MACHINE CO., Toledo, Ohio, has opened a N. Y. City sales and service office with T. J. Mueller in charge. . . . An employee service award banquet was held recently by the OWEN BUCKET CO., Cleveland, Ohio. . . . The BIG THREE WELDING EQUIPMENT CO., of Houston and Fort Worth., Tex. has opened a branch at Lubbock, Tex. . . . CONSOLIDATED STEEL CORP., San Francisco and Los Angeles, Calif., has

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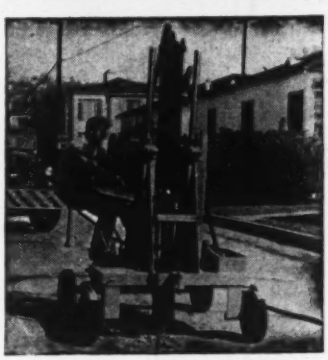

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changed its name to CONSOLIDATED WESTERN STEEL CORP. . . . BLAW-KNOX Co., will acquire the FOOTE CO., INC. of Nunda, N. Y., manufacturer of road-building equipment. . . . TRACKSON CO., Milwaukee, Wis., has occupied a newly acquired plant to combine development and product engineering departments under one roof. . . . FULLER MFG. CO., Kalamazoo, Mich., has established a wholesale factory branch at 1060 E. 11th St., Oakland, Calif. . . . CRAMER MACHINERY CO., construction equipment, has occupied a new office and warehouse at 1005 S. E. Stark St., Portland, Ore. . . . General offices of CECO STEEL PRODUCTS CORP., have been moved to a new office building at 5601 W. 26th St., Chicago 50, Ill.

New Engineering Books

(*Continued from page* 96)

NFPA HANDBOOK OF FIRE PROTECTION—Tenth Edition—By Crosby-Fiske-Forster. 1,544 pp. National Fire Protection Association International, Boston, Mass. $7.

SCIENTIFIC AND TECHNICAL ABBREVIATIONS, SIGNS AND SYMBOLS—By O. T. Zimmerman, and Irvin Lavine. 476 pp. Industrial Research Service, Dover, N. H. $7.50.

TRENDS IN ENGINEERING EDUCATION, THE COLUMBIA EXPERIENCE—By James Kip Finch. 140 pp. Columbia University Press, New York. $2.

FAN ENGINEERING—Fifth Edition—Edited by Richard D. Madison. 808 pp. Buffalo Forge Company, Buffalo, N. Y. $6.

THE ELECTRON MICROSCOPE—ITS DEVELOPMENT, PRESENT PERFORMANCE AND FUTURE POSSIBILITIES—By Dr. D. Gabor. 164 pp. Chemical Publishing Co., Brooklyn, N. Y. $4.75.

TECHNICAL DESCRIPTIVE GEOMETRY—First Edition—By B. Leighton Wellman. 508 pp. McGraw-Hill Book Co., New York 18 and London. $4.

OUR UNKNOWN EX-PRESIDENT—A PORTRAIT OF HERBERT HOOVER—By Eugene Lyons. 340 pp. Doubleday & Company, Garden City, N. Y. $2.95.

BATTLEFRONTS OF INDUSTRY—By David O. Woodbury. 342 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $3.50.

Reports and Pamphlets

PREFABS ON PARADE—By O. W. McKennee and Staff of The Housing Institute, New York. $2.00.

TWENTY-FOUR YEARS OF PROGRESS IN HIGHWAY DEVELOPMENT, 1924-1948—By Department of Highways, Washington, D. C.

A REVIEW OF RAILWAY OPERATIONS IN 1947—By Julius H. Parmelee. Association of American Railroads, Bureau of Railway Economics, Washington, D. C. Special Series No. 77.

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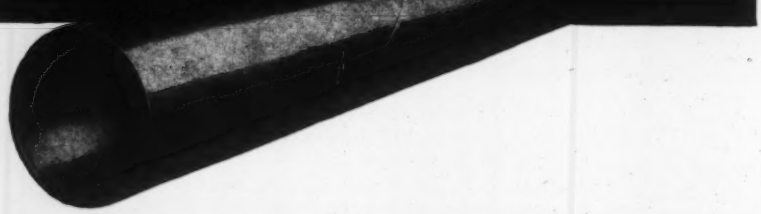

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GROUND-WATER RESOURCES OF THE CINCINNATI AREA, BUTLER AND HAMILTON COUNTIES, OHIO—Geological Survey Water-Supply Paper 999—U. S. Geological Survey. Superintendent of Documents, Washington 25, D. C.

10 YEARS OF ACHIEVEMENT—An anniversary pamphlet issued by Gilbert Associates, Inc., engineers and consultants, Reading, Pa.

WATER RESOURCES, Southern Illinois—Booklet No. 2—By State Water Survey Staff, Urbana, Illinois.

SEDIMENTATION OF RESERVOIRS IN OHIO—Bulletin 17—Ohio Water Resources Board, Columbus, Ohio.

EXPLOSIVE HAZARDS IN UNDERGROUND STRUCTURES—A Report Prepared Under Directions of the Sub-Structure Committee of the City of Los Angeles for the Southern California Gas Co., 1700 Santa Fe Ave., Los Angeles.

THE TWENTY-FIRST ANNUAL HIGHWAY CONFERENCE OF THE UNIVERSITY OF COLORADO—Highway Series No. 21—University of Colorado, Boulder, Colo.

REAL ESTATE AND HOUSING—Prepared by Western Personnel Institute, 30 North Raymond Avenue, Pasadena 1, California.

WASHINGTON'S BRIDGES—HISTORIC AND MODERN—Prepared for Commissioners of the District of Columbia by the Department of Highways, Washington, D. C.

APPRENTICE TRAINING—KEY TO PRODUCTIVITY IN CONSTRUCTION—By Construction and Civic Development Department, Chamber of Commerce of the United States, Washington 6, D. C.

STUDIES IN CEMENT-AGGREGATE REACTION—Bulletin No. 229—Council for Scientific and Industrial Research, Commonwealth of Australia, Melbourne, Australia.

LES GRANDS SOUTERRAINS TRANSALPINS—By Charles Andreae—Ag. Gebr. Leemann & Co., Stockerstrasse 64, Zürich 39, Switzerland. Price 22 francs (Swiss).

SKID RESISTANCE MEASUREMENTS OF VIRGINIA PAVEMENTS—Research Report No. 5-B, Highway Research Board, Washington 25, D. C.

BIBLIOGRAPHY ON FROST ACTION IN SOILS (ANNOTATED)—Bibliography No. 3—Highway Research Board, Washington 25, D. C.

BIBLIOGRAPHY ON USES OF HIGHWAY PLANNING SURVEY DATA (ANNOTATED)—Bibliography No. 4—Highway Research Board, Washington 25, D. C.

REPORT OF COMMITTEE ON CALCIUM CHLORIDE SOIL STABILIZATION—Technical Bulletin No. 127—American Road Builders' Association, Washington 4, D. C.

MODERN STREET INTERSECTION DESIGN—WASHINGTON, D. C.—Municipal Bulletin No. 131. American Road Builders' Association, Washington 4, D. C.

REPORT OF THE COMMITTEE ON MASS TRANSPORTATION—Technical Bulletin No. 134—American Road Builders' Association, Washington 4, D. C.

COMMITTEE REPORT—SOIL-CEMENT STABILIZATION—Technical Bulletin No. 137—American Road Builders' Association, Washington 4, D. C.

INDEX TO ASTM STANDARDS—American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

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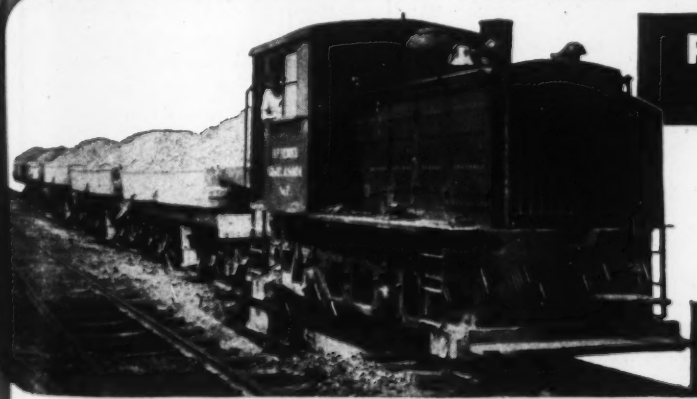

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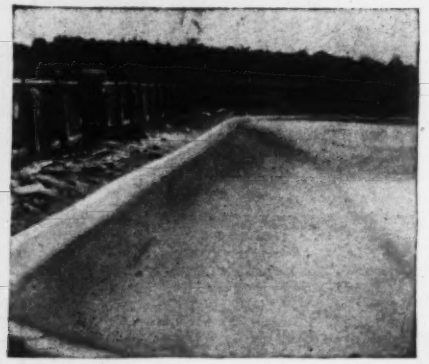

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Engineering Schools

The $1,000 George Westinghouse Award of the American Society for Engineering Education has been awarded to Prof. Hunter Rouse, since 1944 director of the Iowa Institute of Hydraulic Research and since 1939 professor of fluid mechanics at the State University of Iowa.

The award is presented annually by the society for distinguished contributions to the teaching of engineering students. Professor Rouse was cited "for his extensive influence upon the teaching of fluid mechanics, for his revealing synthesis of diverse information, and for his inspiring guidance to students and associates."

Before going to Iowa, Professor Rouse held positions at California Institute of Technology, Columbia University, and Massachusetts Institute of Technology. He held the M.I.T. traveling fellowship in hydraulics from 1929 to 1931, and studied in Germany. In 1938 he was awarded the Normal Medal of the American Society of Civil Engineers, "for an original paper considered an especially distinguished contribution to the engineering profession".

Chi Epsilon, the national honorary civil engineering fraternity, recently made Maj. Gen. L. A. Pick and Julian Hinds national honorary members. General Pick built the Ledo Road and is author of the Pick Plan, a comprehensive program for the over-all control and utilization of the full water resources of the Missouri River basin. Mr. Hinds is an authority on water supply. He is general manager and chief engineer of the Metropolitan Water District of Southern California, with which he has been associated since its inception in 1928.

Prof. F. L. West, director of the school of engineering at Mount Allison University, Sackville, N. B., has been named dean in charge of the summer term at that college. A graduate of McGill University engineering school, Montreal, he has been on the faculty of Mount Allison for 30 years.